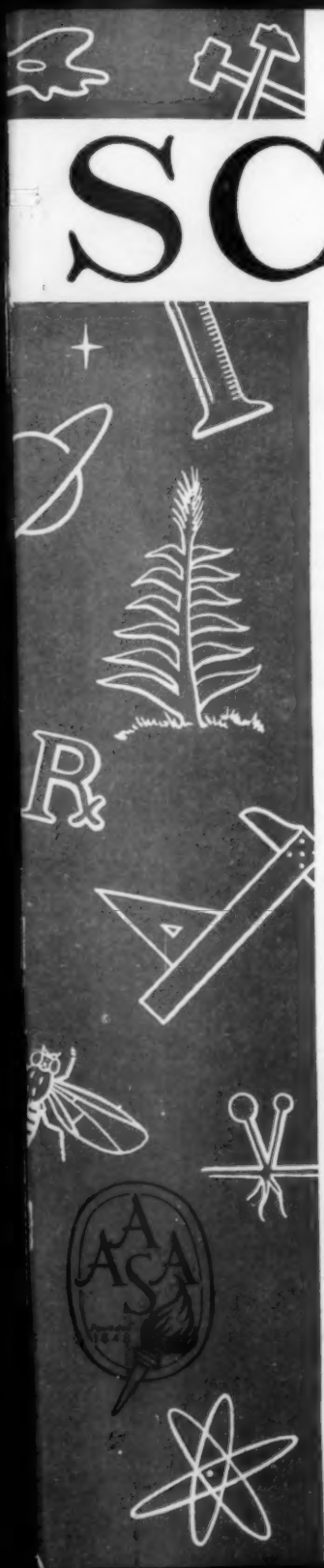

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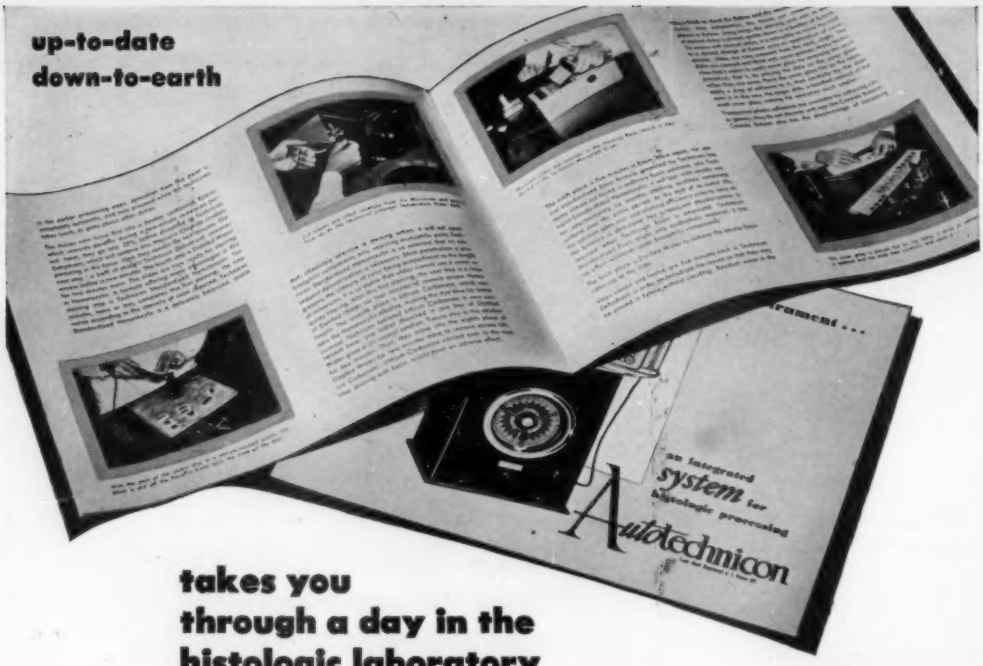

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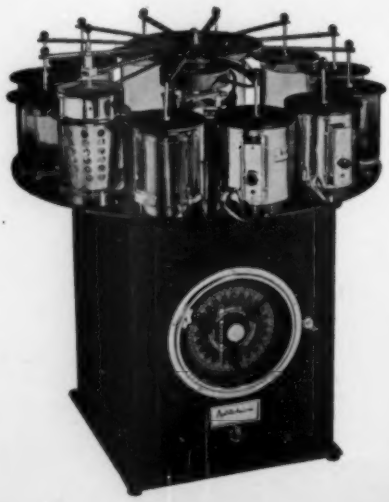

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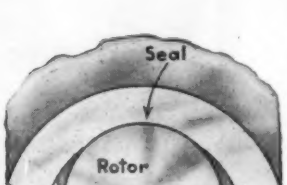

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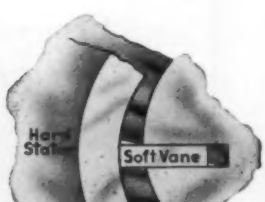

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Plant Science After Fifty Years

On July 1, 1951, organized plant science in the federal government will celebrate its fiftieth anniversary. Although various units dealing with plant science were already in existence in the Department of Agriculture, creation of the Bureau of Plant Industry brought them together on July 1, 1901.

In these fifty years the foundations have been laid for much of our present-day plant science. One of the reasons that the contributions of the Bureau have been so significant and far-reaching has been its cooperative relationships with the state agricultural experiment stations. In the space available we can mention only a few of the high lights.

When the Bureau was created, one of its employees was already making history by deliberately growing cotton plants in wilt-infested soil and selecting individual plants that showed resistance. This was one of the first scientific applications of the principle of survival of the fittest, a principle now widely used in all crop-improvement work.

Other work already in progress when the Bureau was born dealt with bacterial diseases of plants. The discovery that many plant diseases were caused by bacteria was made in Illinois, but Department scientists were among the first to grasp the significance of this discovery and develop practical means for controlling some of these little-understood diseases.

The original concept of hybrid corn came from outside the Bureau, which contributed to the developmental stage and served as coordinator and clearing-house for the many state and federal workers. There is no doubt that hybrid corn came into wide use much earlier because of this teamwork among scientists.

The success of hybrid corn stimulated plant breeders to seek hybrid vigor in other crops. Progress was slow at first, but in recent years the discovery of male sterility in onions, sorghums, tobacco, sugar beets, and many other crop plants has opened the way for additional gains. Success with onions has been striking.

The influence of photoperiod on plants was discovered by two Bureau workers in 1920. The discovery that some plants require long days for flowering and fruiting, whereas others require short days, has many practical applications in present-day agriculture. For example, varieties of plants that bloom at different times can now—by controlling their exposure to light—be made to bloom at a time convenient to plant breeders.

Thirty years ago curly top on sugar beets and mosaic on sugar cane threatened to wipe out these crops. Plant breeders developed varieties resistant to these virus diseases that not only restored production but increased yields and sugar content.

In more recent years Bureau workers have played leading roles in the study of plant-growth regulators. Besides its many contributions to fundamental science, this work led to our present widespread use of chemical weed-killers and preharvest sprays to prevent premature drop of apples and other fruits.

Another development of recent years has been induced polyploidy in plants. Interspecific and intergeneric crosses are now an accepted method of crop improvement, enabling scientists to utilize hardiness and disease resistance of many wild species.

One of the activities for which the Bureau has become known throughout the world is plant introduction. Begun for the purpose of adding desirable new plants to American agriculture, this activity has grown into a highly specialized search for desirable characters, such as hardiness and disease resistance, that plant breeders can use in developing superior new varieties.

Plant science must be closely integrated with research on soils and work in agricultural engineering to be most useful to farmers. This was recognized by the merger of these activities to form the present Bureau of Plant Industry, Soils, and Agricultural Engineering.

E. G. Moore
L. E. Childers

ARA, U. S. Department of Agriculture
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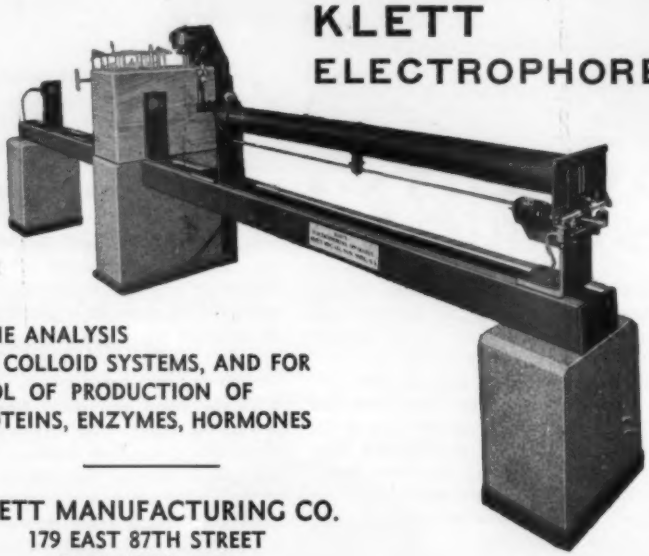

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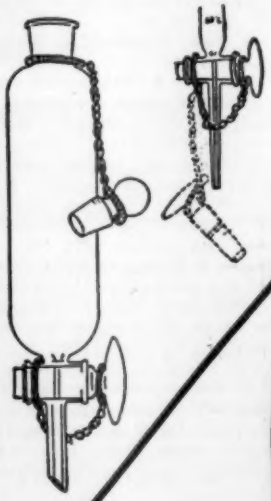

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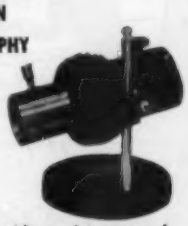

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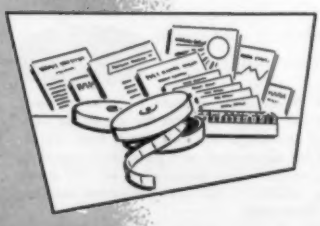

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Mobilization of Scientific, Engineering, and Medical Manpower: An Interim Report[1]

Charles V. Kidd

National Institutes of Health, U. S. Public Health Service, Federal Security Agency

AS THE PACE OF THE NATION'S DEFENSE EFFORT ACCELERATES, demands for scientific, engineering, medical, and other technical manpower are pressing more closely upon severely limited resources. The shortages that have already developed, and those that are clearly ahead, have both alarmed those who feel their effects most sharply and brought a measure of public action. At this point it may be helpful to review briefly what has occurred during the past few months and to state the general considerations that seem to militate for and against effective resolution of manpower problems in critically important fields.

General Background

Factors favorable to effective use of scientific manpower. The dramatic and fully publicized research and development accomplishments during and after World War II have created an unprecedented understanding of the central role of research as a source of industrial and military strength. This is reflected in greater willingness on the part of the general public and Congress to view highly trained scientific personnel as a resource that must be used most effectively, and to see the maintenance of a flow of people trained in scientific fields as a major mobilization objective.

College administrators recall the drop in enrollment and the decline in output of trained people during World War II. The number of persons granted Ph.D. degrees in the natural sciences dropped from 2,034 in 1941 to 833 in 1945:[2]

1941	2,034	(Prewar peak)
1945	833	(World War II low)
1946	948	
1947	1,463	
1948	1,947	
1949	2,936	
1950	4,160	(Estimated)

The drop would have been catastrophic if the war had continued for a few more years. Indeed, at the current and contemplated levels of production and research, 4,000 Ph.D.s per year is a thin crop, as shown by these 1950 graduating class figures.[3]

Field	Ph.D.s
Biochemistry	116
Biology	81
Chemistry	953
Geology	113
Mathematics	46
Physics	358

This is the peak annual flow into the scientific corps of a nation of 150,000,000, an economy operating at the level of $290 billion per year, and a research and development program of greater magnitude than the world has ever seen before.

Even with the postwar increase in the number of Ph.D.s produced per year, the total output over the period 1941–50 is still about 3,000 below the number that would have been produced if the 1941 rate had prevailed throughout that period. The significance of this figure is grasped more readily when it is placed against the total number of persons with Ph.D. degrees in scientific fields:[4]

Field	Ph.D. degree
Total	34,000
Chemistry	12,000
Physics	3,400
Geology*	1,400
Biological sciences	7,000§
Agricultural sciences	3,000§
Medical sciences†	3,000§
Other‡	4,200

* Including geophysics.

† Includes such fields as anatomy, pathology, and physiology.

‡ Includes such fields as astronomy, mathematics, and meteorology, and 1,200 engineers.

§ Distribution of total of 13,000 for these three fields estimated by the author on basis of Bureau of Labor statistics data.

The prospect that a relatively high degree of mobilization will continue for a number of years has created apprehension that the danger averted during World War II may not be averted during the years ahead. This apprehension is based in part upon a clearly foreseeable and substantial expansion of demand generated by a vast increase in expenditures for research and development and a rapid build-up of defense facilities and supporting production.

Industry is just beginning to feel the impact of defense orders on production and on the expansion

[1] Based on statements prepared for meetings of the Advisory Councils of the Public Health Service, Feb. 15–17, 1951.

[2] *Report on Scientific Manpower.* Washington, D. C.: Office of Scientific Personnel, National Research Council (Nov. 1950).

[3] *Earned Degrees Conferred by Higher Educational Institutions, 1949–50* (Circular No. 282A, Nov. 1950). Office of Education, Federal Security Agency.

[4] *The Nation's Scientific and Technical Manpower* (Manpower Report No. 3). U. S. Department of Labor, Bureau of Labor Statistics (Dec. 4, 1950).

of physical facilities. Demands for new plants and equipment are expected to increase from about $18.5 billion in 1950 to almost $24 billion in 1951.[5] Even at 1950 levels of construction and other activities generating demands for engineers, the peak crop of 52,000 engineers was easily absorbed. The research and development budgets of the armed forces alone have followed this course:[6]

	Millions
July 1949–June 1950	$ 600
July 1950–June 1951	1,200
July 1951–June 1952	1,500

The significance of these figures lies partly in the fact that there is a substantial lag between the appropriation of funds and the actual generation of demand for manpower. The full impact of the $1.2 billion appropriation for fiscal year 1951 will not be fully felt until this summer.

Manpower and not money will limit the volume of research. The forces creating demands for the services of scientists and engineers are so vast that refined measurements of demand for the period ahead are simply a means of identifying where shortages will be most extreme. In the face of these demands, an inevitable decline in the output of engineers and scientists has set in. Although 52,000[7] engineers graduated in 1950—the postwar peak—only about 30,000 are graduating this June. Thereafter, the annual rate of output will be about as follows:

Year	No. graduates
1952	25,000
1953	20,000
1954	17,000

This drop can be quite precisely predicted through 1954 because those who will graduate in that year entered college last fall. The September 1950 group of engineering freshmen numbered about 30,000.

Moreover, the output of students receiving a B.S. degree in the natural sciences reached a peak in 1950:[8]

Year	No. graduates (B.S. degrees)
1948	34,000
1949	45,400
1950	57,400

As is true of the output of engineers, these are peak levels, and a sharp decline will occur during the next four years even if no students should be inducted into the armed forces. A reduction to 50 or 60 per cent of 1950 output levels is probable by 1954. By selected field, these patterns of output are optimistic even if the proportion of all college graduates in scientific fields rises:

Field	B.S. degrees*	
	1950	1954
Total	57,400	34,300
Chemistry	10,500	6,300
Physics	3,400	2,100
Geology	3,000	1,900
All other	40,000	24,000

* About 60 per cent of 1950 levels.

Not only will the output of persons with B.S. degrees decline, but the pool from which Ph.D. candidates are drawn will shrink. This suggests that relatively greater attention must be paid to drawing undergraduates into scientific and technical fields early in their college careers, perhaps through expansion of scholarships at the expense of graduate fellowships.

Finally, there is weighty evidence that the demand for physicians and other health personnel will far outstrip the supply. Population increase, needs of the armed forces, civilian defense requirements, demands of medical schools, and staffing of national, state, and local public health services will, as estimated by the Health Resources Advisory Committee of the National Security Resources Board, create a need for 32,600 additional physicians by 1954. The same group estimated a net increase over that period—graduates minus those who will die or retire—of about 10,600, leaving a deficit of 22,000 doctors. "Obviously and inescapably we shall see a grave shortage of physicians during the next five years for the needs of a mobilized economy."[9]

President Roosevelt's request in 1944 to Vannevar Bush to frame a long-range scientific policy for the nation produced *Science the Endless Frontier*. This volume proposed the establishment of a National Science Foundation. The proposal in turn was the focus of widespread lay and scientific discussions and general public debate extending over a five-year period and ending with the establishment of the National Science Foundation.

In 1947 the President's Scientific Research Board—a group of scientific administrators from the military and civilian research establishment set up by executive order—issued a report (*Science and Public Policy*) that dealt with scientific policy for the nation and particularly for the federal government.

The debates preceding passage of the *Atomic Energy Act* saw physicists and other scientists actively engaged in discussions of general public policy and of such specific questions as civilian versus mili-

[5] *Building America's Might, A Report to the President by the Director of Defense Mobilization*, No. 1 (Apr. 1, 1950).

[6] Budget for Military Funds of the Department of Defense for Fiscal Year 1952, p. 23. (Transmitted by the President to Congress on Apr. 30, 1951.)

[7] All figures relating to engineers are drawn from S. C. Hollister. *The Developing Critical Shortage of Engineers* (A Report to the Engineering Manpower Commission of the Engineers Joint Council (Dec. 18, 1950).

[8] *Nation's Scientific and Technical Manpower* (*Manpower Report No. 3*). U. S. Department of Labor, Bureau of Labor Statistics (Dec. 4, 1950).

[9] *Medicine, Mobilization and Manpower*, a paper presented to the Council on Medical Education and Hospitals of the American Medical Association by Howard Rusk, chairman of the Health Resources Advisory Committee of the National Security Resources Board (Chicago, Feb. 12, 1951).

tary control of atomic energy development, patent policy in this field, and the place of private industry in atomic energy development.

The net result of activities such as these has been not only to create unprecedented interest in public affairs among scientific groups, but to make them more effective in expressing their opinions—including their views on scientific manpower—in a manner that influences administrative and Congressional action.

The expansion of research by the federal government—both within its own laboratories and through support of research in industry, private foundations and associations, and universities—has been accompanied by a phenomenal growth of advisory groups composed of lay and scientific people. These groups provide a means of bringing a broad array of scientific judgment to bear upon public policy and of acquainting a large group of scientists with the considerations of public policy that affect the decisions of the federal government in the field of science.

The cumulative effect of the activities of these advisory bodies has been to keep the heads of the executive agencies, military and civilian, more keenly aware of the significance of research and of scientists than before World War II. Communication among the scientific, political, and administrative worlds is not perfect, but it is certainly freer than when those who knew the military potentialities of atomic fission had a hard time being heard.

Before World War II, there were no channels—or only very tortuous and relatively ineffective channels—through which scientific matters and questions of general policy relating to science and scientific manpower could be brought effectively to the point of decision in the executive agencies and in Congress.

Unification of the armed forces, whatever else remains to be done, has resulted in the establishment of a single point in the Department of Defense where manpower mobilization questions under the jurisdiction of the armed forces, including the mobilization of scientific manpower, can be resolved. The existence of three very loosely coordinated sets of armed forces manpower policies during World War II effectively forestalled consistent and reasonable action on many important questions. The Research and Development Board, a consolidated research planning organization for all three branches of the armed forces, had no counterpart before or during World War II.

The Interdepartmental Committee on Scientific Research and Development, created by executive order in 1947, is a device for drawing together the federal agencies with research responsibilities, and for transmitting to the Bureau of the Budget and the President the combined views of the research enterprises of the federal government.

The National Science Foundation can, by directing its attention to basic questions of national scientific policy, also exert substantial influence upon both Congressional and executive thinking and action.

Factors impeding effective mobilization of scientific manpower. From the experience of World War II, it would be relatively easy to set up the principles of, and the administrative machinery for, complete mobilization of manpower. More important, scientists would be more inclined to accept the burdens imposed by a plan for full mobilization if it could be assumed that a full effort were called for.

It is the in-between stage, and the impossibility of setting a single clear goal—like winning a shooting war—that create problems. To cite a specific example, if we could assume that our armed forces would not go above 3.5 million or so for five years, and that for the indefinite future each crop of 18-year-olds would go in for 27 months of service, we could ignore the problems of sustaining the flow of trained men. We could simply take a two-year decline in output of college-trained scientists and rely on the group returning from military service to supply the necessary men. But since this assumption cannot safely be made, the difficult political and moral problems involved in sustaining a flow of highly trained manpower through college must be faced and resolved.

The major problems of defense mobilization fall into three areas—economic stabilization, production, and manpower. For the first two of these, both centralized authority and a central operating organization exist—the Economic Stabilization Administration and the National Production Administration under the Office of Defense Mobilization. These agencies have their problems, and they may undergo some mutations, but machinery exists and it is operating.

In the manpower field, including scientific and technical manpower as part of the total problem, the situation is quite different. A clear declaration of national policy exists:

> We must rely heavily on science and technology. The most effective use must be made of our supply of individuals having the special skills required to develop and produce the necessary equipment and to use and maintain it in the armed forces . . . this involves constantly increasing our mobilization potential through training and educational programs to expand our supply of persons with highly developed skills essential to civilian and military activities.[10]

Although this policy sets a general course, its implications are not always clear "at the operating level." Authority and responsibility are in practice somewhat fragmented, and the two are not always lodged in the same place.

The major agencies that have performed various staff and operating functions relating to manpower—engineering, scientific, and medical, as well as other groups—include the Office of Defense Mobilization, the Office of Education of the Federal Security Agency, the National Security Resources Board, the Office of Defense Manpower of the Department of Labor, the Department of Defense, and the Selective Service System. These pieces will probably fit together in shifting patterns for some time to come.

[10] National Manpower Mobilization Policy, promulgated by the President in a memorandum to heads of executive departments and agencies, Jan. 17, 1951.

At the moment, the manpower function is performed for the Office of Defense Mobilization by a Manpower Policy Committee and not by an operating agency. A Committee on Specialized Personnel has been established to supply this Manpower Policy Committee with information on the supply of, and demand for, specialized personnel, and to recommend policies for training, allocation, and utilization of these people. This action came after a period of study and a set of recommendations by the Scientific Manpower Advisory Committee (the "Thomas Committee") under the chairmanship of Charles Thomas, of the Monsanto Chemical Company. But the new advisory committee is a far cry from the operating agency recommended by the Thomas Committee,[11] which dissolved itself upon creation of the new Committee on Specialized Personnel.

In this complicated and changing administrative situation, it has been difficult to secure general decisions affecting engineering, scientific, and medical personnel. It has been even more difficult to take action with respect to these specialized groups because the machinery for administering decisions is rudimentary. Until a single agency is given general authority in the field of manpower comparable to that now in effect in the fields of production and economic stabilization, the groups working on scientific manpower problems, both within and outside the federal government, will operate under severe handicaps.

Although virtually all categories of medical and scientific personnel are in extremely short supply, provision of manpower for industrial production will not cause acute difficulties for some time to come, except for a few occupations in a few areas. It is quite possible that the pressures required to bring about the establishment of a unified manpower agency will not be strong enough until industrial manpower problems are acute. In the economic stabilization and production fields, single operating agencies were not established until inflation threatened the stability of the economy and expansion of production became essential to national survival. Meanwhile, policies and administrative organizations for scientific, medical, and related manpower will apparently be handled as appendages to the general mobilization machinery.

Until decisions are reached on how the armed forces are to secure their manpower, a number of problems in the general manpower field must remain unresolved. The minimum age at which men will be drafted, for example, has an obvious effect upon college training. A decision on policies governing the call-up of reservists has to be linked to total plans for the increase and maintenance of the armed forces. The Department of Defense was understandably disinclined to overhaul the reserve system until the universal military service issue was settled.[12]

[11] *Plans for the Development and Use of Scientific Manpower.* National Security Resources Board (Jan. 12, 1950).

[12] The Senate hearings on this bill—S. 1—are a gold mine of opinion and facts on all aspects of the manpower problem. (Hearings on the Universal Military Training Act of 1951 [S. 1, 1st Session, 82nd Congress], before the Preparedness Subcommittee of the Committee on Armed Services.)

Current Problems—College Training and Call-Up of Reservists

Two problems relating to scientific, medical, and engineering manpower have been particularly pressing over the past few months—namely, establishment of a means of ensuring a flow of students through college in the face of expanding demands for military manpower and establishment of a mechanism for recalling reservists in a manner least disruptive to essential activities.

A deferment program, established by Executive Order 10,230 on March 31, 1950, was spelled out by General Hershey. The general principles of the plan were developed over a two-year period of study by six advisory committees to the Selective Service System under the general chairmanship of M. H. Trytten, director of the National Research Council's Office of Scientific Personnel. It provides for deferment of students now in college and graduate or professional school on the basis of satisfactory performance and class standing, with final authority for deferment retained by local boards. Since most high-school students who graduated last June are not likely to be called before the fall semester, and since those who enter college in the fall will probably remain until the end of the year, they need only be accepted by a college in order to enter the freshman class next fall.

Announcement of the plan raised a furor of substantial proportions centering around charges that bright boys and those with money enough to attend college would be left as civilians while all others would serve in the armed forces. In all likelihood, however, this program will go into effect. Although the plan was devised as a stopgap pending the enactment of a long-term universal training and service law, it may well serve, with modifications, as the basis for ensuring an uninterrupted flow of college-trained specialists, now that such a law has been enacted.

Whereas policies with respect to college training will determine the output of scientifically and medically trained people in the years ahead, a more immediate problem is the manner in which the armed forces call up their reserves. The basic issue here is that the armed forces have traditionally regarded reservists as property on which they had a lien. This was a logical and defensible policy when reserve components were small, and when the bulk of the reserve forces was currently trained, cohesive, and relatively small.

Now the reserve forces are extremely large, and a substantial portion of the reserve is simply a reservoir of manpower available on call by the armed forces, rather than a relatively modest, specifically trained group. Recall of reserves—particularly those with scarce skills—without regard to the need for the individual in essential civilian employment threatens to disrupt large areas of defense production, research, and medical care. What is needed is a complete change in the concept of the function of reserve components, the size of the reserves, and the factors that will enter into decisions to call up individuals.

The Department of Defense is fully aware of this problem and realizes that drastic changes in reserve policy are needed. It has agreed to produce a plan for handling the reserve problem. In the interim, those who are faced with the loss of critically important reservists can ask for, and will probably receive, a six-month delay in call-up. There is no uniform policy on release of reservists from the armed forces. Reservists are called up independently by each branch of the armed forces, and each branch of the service has decentralized call-ups. This procedure makes it impossible to balance total military and total civilian requirements, and to select individuals rationally.

Call-up of medical and related reservists is an exception to this generalization, largely as a result of agreements worked out between the Department of Defense and the Health Resources Advisory Committee to the Office of Defense Mobilization (originally advisory to the National Security Resources Board), under the chairmanship of Howard Rusk. The problem was twofold: determination and administration of a reasonable division of the total medical and related manpower pool between the civilian economy and the armed forces, and establishment of criteria to guide the call-up of individual reservists.

To solve the first problem, the Department of Defense has agreed to submit its total prospective requirements for medical and related personnel to the committee for comment and advice. Although the committee has no authority to set the level of armed forces medical manpower requirements, it advises the President, and its advice will undoubtedly be taken seriously. This procedure was inaugurated in midyear because the call for the first half of 1951 had already been planned. This method is extremely significant as a precedent for dealing with all categories of scarce, highly trained manpower.

So far as selection of individual reservists for call-up is concerned, the Department of Defense submits to the Rusk Committee a single requisition stating the number and types of medical manpower it intends to call up. The committee sets quotas by state, and the state committees advise the armed forces as to which individuals should be called up. Their decisions are based on the relative essentiality of reservists in civilian life.

This reserve plan, which is simple, sets a number of significant precedents. The three branches of the armed forces have agreed that the Department of Defense will place a single consolidated requisition for these types of manpower. The Department of Defense has agreed that civilian groups should select the individuals who will be called. The branches of the armed forces have agreed to exchange reservists in order to ensure the most effective use of the men called. Most significant, the Department of Defense has agreed to effective review of the over-all allocation of medical personnel between military and civilian life.

If these principles were extended to cover scientific manpower, some of the most acute current difficulties would be resolved, and many that can be clearly foreseen would be mitigated.

Prospective Problems—Effective Allocation and Utilization of Specialized Manpower

Even with an adequate college-training program and a revamped armed forces reserve policy, shortages of engineering, scientific, and medical manpower will be acute. Indeed, they will be so acute that the question of allocation—voluntary or compulsory—will almost certainly be more intensively considered and debated during the next few months. The competing demands for highly trained manpower will in all probability lead to disruptive competitive bidding and piracy among industrial concerns, universities, and the government, on a scale that will require either voluntarily negotiated agreements or controls involving some degree of compulsion.

If compulsion is to be avoided—and the case against compulsion is so obvious on a number of grounds that it need not be discussed—the cooperation of individual scientists and the groups into which they are organized will be essential. Representatives of scientists, engineers, and the medical professions have given generously of their time over the past few months on advisory groups to federal agencies, formulating plans and advocating their adoption.

Even with the wholehearted aid of the scientific, medical, and engineering community it will be difficult to arrive at sound policies and carry them out in an atmosphere of crisis, where powerful and conflicting forces are in operation. It is, indeed, unrealistic to expect that the multitude of problems bearing on the training and use of highly specialized manpower will ever be "solved," because the problems keep changing. For this reason, the continuing aid, criticism, and cooperation of individuals and groups from outside the federal government are indispensable, even though those who participate in this complex process may at times feel that rejection or modification of some of their ideas and proposals means that their efforts have been ineffective. Specialized groups cannot, and should not, expect to settle all elements of national policy affecting them and their work, but they should and can have a voice if the pattern of collaboration developed over the past few years persists.

Technical Papers

The Preparation and Properties of Tetrakistrichlorophosphine Nickel[1]

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Trivalent phosphorus compounds have an electron pair available for the formation of dative covalent bonds. A number of complex compounds of divalent palladium and platinum have been prepared which contain phosphorus trihalides, trialkyls, trialkoxy derivatives, trihydroxide (phosphorous acid), and trihydride (phosphine) (*1,2*). Since these compounds are analogous in many ways to the carbonyl complexes of divalent palladium and platinum halides (*1*), trivalent phosphorus might be expected to form analogs of other metal-carbonyl complexes and possibly analogs of the zero-valent metal carbonyls such as $Ni(CO)_4$. Such a possibility has recently been envisaged by Chatt (*2*) for phosphorus trifluoride.

In 1936, A. A. Blanchard, of MIT, predicted that phosphorus trichloride should form an analog of nickel tetracarbonyl, and from a consideration of the effective atomic number and molecular symmetry suggested that the compound would be volatile. At that time, at the suggestion of Professor Blanchard, one of the authors (JWI) made preliminary attempts to prepare the analog of nickel tetracarbonyl with active nickel (from the low-temperature reduction of nickel formate with hydrogen) and phosphorus trichloride vapor or liquid. A definite exothermic reaction occurred, but only small amounts of compound were recovered from several runs. Direct displacement of carbon monoxide from nickel tetracarbonyl in a sealed tube was then tried. The desired reaction occurred, as indicated by the yellow color that developed in the solution of phosphorus trichloride. When the reaction tube was cooled in liquid air prior to opening, the color faded and no product was isolated from the mixture. Subsequent observations of this system suggest a readily reversible equilibrium:

$$Ni(CO)_4 + 4PCl_3 = Ni(PCl_3)_4 + 4CO.$$

The equilibrium is shifted to the left at low temperatures, but the reaction goes readily if the CO is allowed to escape.

After noting the lack of volatility of the compound, work was discontinued until recently. We have now separated the compound, tetrakistrichlorophosphine nickel, and report some of its properties, together with a few studies on related syntheses. Complete replacement of the 4 dative groups in nickel tetracarbonyl has also been achieved by Hieber (*3*) with phenyl isocyanide.

[1] This work was supported in part by the United States Atomic Energy Commission.

Preparation. The light-yellow tetrakistrichlorophosphine nickel, $Ni(PCl_3)_4$, is readily formed by direct action in the liquid phase of phosphorus trichloride on nickel tetracarbonyl. Excess phosphorus trichloride is added to the carbonyl, whereupon CO is immediately evolved and the solution becomes pale-yellow in color; the reaction is completed by heating on a steam bath under a reflux condenser. Most of the excess of the phosphorus trichloride is removed by distillation to leave a yellow solution from which the coarsely crystalline precipitate may be obtained on cooling. The method of separation used, however, has been to dissolve the residue in pentane at room temperature and to crystallize the product as fine crystals by cooling the solution to $-60°$ C. Two crystallizations are sufficient to remove all phosphorus trichloride. The solid is dried on a porous plate. All crystallizing and drying operations are carried out in an atmosphere of dry CO_2.

Analysis. For determinations of phosphorus and nickel, the compound was destroyed by boiling with strong nitric acid, with the addition of a few drops of hydrogen peroxide. Gravimetric determinations were made (*4*) of nickel by the dimethylglyoxime method and of phosphorus by the ammonium molybdate method. For the determination of chloride, the compound was destroyed by boiling with strong sodium hydroxide, and, after acidification with nitric acid, the chloride was precipitated with silver nitrate from 3*N* nitric acid solution. The results of analyses are given in Table 1, the sum of the average percentages being 99.82%.

TABLE 1

Element	Determined %	Calcd for $Ni(PCl_3)_4$,%
Ni	9.67 9.62	9.65
P	20.25 20.30	20.35
Cl	69.97 69.85	70.00

Properties. Tetrakistrichlorophosphine nickel is a thermochroic crystalline solid, being pale-yellow at room temperatures and white on cooling to about $-30°$ C. The compound is stable in air and unreactive with water at room temperatures over a period of several days. With dilute acids, concentrated sulfuric acid, or concentrated hydrochloric acid, it reacts very slowly in the cold. In hot solutions attack is quite rapid. Ammonium hydroxide reacts rapidly to give a brown solution. Sodium hydroxide reacts very slowly, giving a black precipitate and a solution of sodium phosphite. On heating, no decomposition occurs below 120° C; at higher temperatures blackening and loss of phosphorus trichloride occur, and there is evidence

for the formation of nickel chloride and polymeric phosphorus dichloride. The tetrakistrichlorophosphine nickel appears to be nonvolatile.

The compound is readily soluble in organic solvents. With dry, air-free, inert solvents such as benzene, carbon tetrachloride, pentane, and cyclohexane, there is only very slow decomposition at room temperatures. On heating the solutions, decomposition is rapid, to give black precipitates of nickel. The solubility in pentane at $-50°$ C is 0.9 g/100 g pentane. In solution in organic solvents such as alcohols and ketones, decomposition leading to green and brown solutions is quite rapid. With carbon disulfide, rapid blackening of the solution occurs; the products of this reaction have not been studied in detail, but the reaction appears to be similar to that reported for nickel carbonyl and carbon disulfide (*5*), where polymeric carbon monosulfide was formed.

Determination of the molecular weight by the method of freezing point depression in benzene gave a value of 600 ± 20, corresponding to the monomeric state of $Ni(PCl_3)_4$ (theoretical mol wt, 608).

Single hexagonal crystals of $Ni(PCl_3)_4$ several millimeters long can be grown by slow cooling of benzene solutions from 25° C to 10° C. The density of the compound, determined by the standard pycnometer method of weighing in water, is 2.10 ± 0.01 at 25° C.

The magnetic susceptibility of $Ni(PCl_3)_4$ at 25° C has been measured by the Gouy method. Air ($K = +0.029 \times 10^{-6}$ cgs) and water ($K = -0.72 \times 10^{-6}$ cgs) were used as standards, and as a check on the calibration curve of field vs. current, for the magnet used. In all cases the field was varied from about 5,000 to 9,500 oersteds, and the susceptibility values obtained were independent of field strength, showing the absence of ferromagnetic impurities. Measurements made after successive crystallizations from pentane solutions gave a value for the specific mass susceptibility χ for $Ni(PCl_3)_4$ of -0.355×10^{-6} cgs. For PCl_3 under the same conditions, χ is -0.455×10^{-6} cgs; the molar susceptibilities χ_m are then -216.0×10^{-6} cgs and -62.3×10^{-6} cgs for $Ni(PCl_3)_4$, and PCl_3, respectively. In the compound $Ni(PCl_3)_4$ the apparent molar susceptibility of nickel is hence $+33 \times 10^{-6}$ cgs. The measurements thus show complete filling of the nickel *d* orbitals and the absence of unpaired electrons, confirming that nickel is in the zero-valent state in the compound; the small paramagnetism may be of the temperature-independent type found in $KMnO_4$, $K_2Cr_2O_7$, etc.

Related reactions. Evidence has been obtained for intermediate replacement compounds in the reaction of nickel carbonyl and phosphorus trichloride, although these have not as yet been isolated. Preliminary investigations of the reaction of nickel carbonyl with phosphorus tribromide directly and in pentane solution have been made. At room temperature, the reaction is rapid, CO being evolved with effervescence, and a yellow solution is formed which later turns orange-red as the reaction proceeds. No bromide replacement compounds could be isolated from these solutions, however; if the orange-colored solution is warmed or allowed to stand for an hour or so, even at 0° C, decomposition occurs and a brown flocculent precipitate is produced.

Tetrakistribromophosphine nickel, $Ni(PBr_3)_4$, has been made by the reaction of PBr_3 and $Ni(PCl_3)_4$ and will be described subsequently, together with the preparation and properties of other complexes of nickel carbonyl and iron pentacarbonyl formed with the lower halides of phosphorus and antimony.

With AsF_3, $AsCl_3$, and $AsBr_3$, nickel carbonyl reacts readily in both liquid and vapor phases, liberating CO and forming black products; no definite compounds have been isolated.

No replacement compounds have yet been isolated from the reaction of PCl_3 with molybdenum, wolfram, and chromium hexacarbonyls at temperatures up to 150° C; solid products obtained appear to be mainly the metal phosphides.

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The Respiratory Effect of Ro 2-3198 (3-Hydroxy Phenyldimethylethylammonium Bromide) in Syncurinized Dogs[1]

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Most anesthesiologists find little use for neostigmine in the treatment of overdosage of curare products, being satisfied with augmented or controlled respiration for a period of time. Furthermore, the undesirable cholinergic effects and prolonged action of neostigmine have limited its use in anesthesia practice.

However, a short-acting anticurare drug with minimal undesirable cholinergic responses and low toxicity would most assuredly have a place in the treatment of depression from curare. A long series of phenolic quaternary ammonium salts has been studied, and among these derivatives Ro 2-2561 (3-hydroxy phenyltrimethylammonium bromide) (*1–4*), Ro 2-2017 (3-acetoxy phenyltrimethylammonium methylsulfate) (*5–7*), and Ro 2-3198 (3-hydroxy phenyldimethylethylammonium bromide) (*2–4*) were found to be effective in antagonizing curare activity.

We became interested in the response of the anticurare drug Ro 2-3198 to syncurine (bistrimethylammonium decane bromide) because its curarelike ac-

[1] Preliminary report.

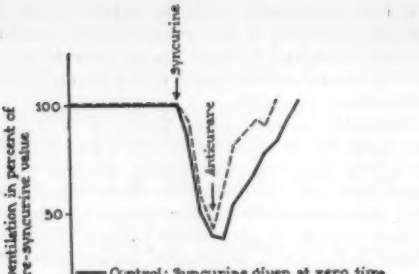

FIG. 1. Respiratory response in syncurinized dogs with and without Ro 2-3198. Total ventilation expressed as percentage of presyncurinized value.

tion cannot be antagonized or inhibited by anticholinesterases such as eserine and neostigmine (*8*). Paton and Zaimis (*8, 9*) claimed that C-5 (bistrimethylammonium pentane diiodide) is an effective antidote, but it seems to have no useful place in anesthesia because of its autonomic blocking effect, which might be a contributory factor in operative shock (*10*).

We performed a series of experiments in an attempt to evaluate the anticurarelike action of Ro 2-3198 in syncurinized dogs. The minute volume and tidal air were used as an index of its effectiveness.

Mongrel dogs (15–31 lbs) were anesthetized with sodium nembutal (6.5%) administered intravenously at a dosage of 1 ml/5 lbs body weight, and premedicated with atropine sulfate.

A Magill endotracheal tube with cuff was inserted into the trachea, and the cuff was then inflated with air until there was no leakage around the tube. The tube was tightly connected to the standard Benedict-Roth basal metabolism machine. Continuous kymographic tracings were recorded until a constant respiratory volume was obtained for at least 10 min. Syncurine was then administered in the control group, and syncurine followed by anticurare (Ro 2-3198) in the testing group. In both groups the kymographic tracings were continued until the total ventilation or minute volume returned to the presyncurine level. The

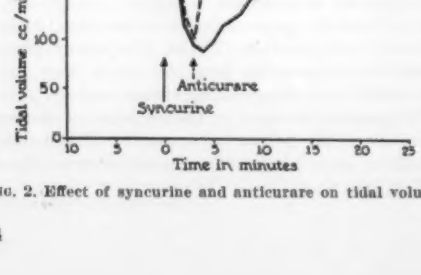

FIG. 2. Effect of syncurine and anticurare on tidal volume.

respiratory volume and the tidal air were calculated and corrected to BTPS (body temperature, ambient pressure, and saturation).

Both syncurine and Ro 2-3198 were injected intravenously through the antitibial vein over a constant period of 1 min. The interval between the start of the administration of syncurine and the start of Ro 2-3198 was 3 min. Syncurine was given at zero time.

The dose of syncurine was chosen arbitrarily as 0.03 mg/lb body weight, which is about that for man based on body weight. A dosage of 0.15 mg/lb body weight was used for Ro 2-3198.

Fifteen experiments were done in 6 dogs (6 control and 9 testing experiments).

The results of the respiratory responses to Ro 2-3198 in syncurinized dogs were presented in average curves.

1. The effect of syncurine on respiration in anesthetized dogs is short in duration, reaching maximal respiratory depression by the fourth minute after the start of injection of syncurine. From this point, the minute volume gradually increases and returns to normal in 10.83 min (10.83 ± 23.64%) after the administration of syncurine (Fig. 1).

2. In the testing group in which Ro 2-3198 was given 3 min after the injection of syncurine, an immediate response was obtained. A 25% increase in minute volume was noted by the end of the administration of Ro 2-3198 (whereas in the control group the minute volume was still decreasing). In the testing group the minute volume returned to normal in 6.89 min (6.89 ± 19.89%) (Fig. 1). These differences are statistically significant.

3. The respiratory depression is chiefly manifested by the decrement in tidal volume. After the injection of Ro 2-3198 there was an immediate increase in tidal volume (Fig. 2). In each trial the effect was observed within 20–30 sec of the beginning of the injection of Ro 2-3198 (Fig. 3).

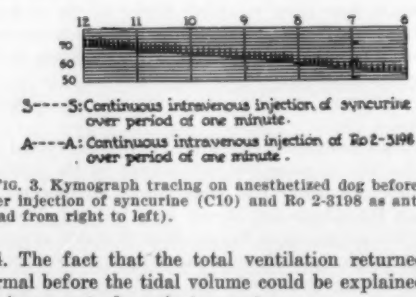
6 5 4 3 2 1 0
50
40
30
A A S S
12 11 10 9 8 7 6
70
60
50
S----S: Continuous intravenous injection of syncurine over period of one minute.
A----A: Continuous intravenous injection of Ro 2-3198 over period of one minute.

FIG. 3. Kymograph tracing on anesthetized dog before and after injection of syncurine (C10) and Ro 2-3198 as antidote (read from right to left).

4. The fact that the total ventilation returned to normal before the tidal volume could be explained by the increment of respiratory rate.

5. Repeated doses of syncurine (without Ro 2-3198) produced a constant respiratory depression. This is

contrary to the effects of repeated doses of syncurine on grip strength as reported by Macfarlane *et al.* (*4*). This may explain in part some of the clinical difficulties experienced with syncurine, since repeated doses are less effective in producing relaxation and at the same time respiration continues to be depressed.

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Liquid Nitrogen as a Tool for Obtaining Homogeneous Bacterial Suspensions

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In studies on the physiology, serology, and pathogenicity of microorganisms, uniform suspensions are necessary but frequently difficult to obtain. In some serological work with *Erysipelothrix rhusiopathiae* we experienced difficulty because of autoagglutination. In a search for better methods of preparing satisfactory antigens for agglutination studies, the use of liquid gases suggested itself. Liquid nitrogen was chosen because of its temperature, its chemical inertness, and its rapid evaporation. Other liquid gases would probably serve as well.

The method used for preparing suspensions was as follows: A washed suspension of killed organisms was centrifuged, the supernatant liquid removed, and the organisms transferred to a mortar. A small amount of liquid nitrogen was added, and the frozen organisms were ground with a pestle until they had thawed. The procedure was repeated, and the bacteria were resuspended in saline. Occasionally the organisms were dried by washing with cold acetone before being subjected to liquid nitrogen treatment.

As compared to controls, the preparations obtained by this method were more finely dispersed, and the organisms remained in suspension for long periods.

Living cultures of mycobacteria, both virulent and avirulent, harvested from slants of Petragnani medium, were successfully suspended by the same method. Microscopic examination showed clumping to be negligible. The organisms retained their viability as shown by growth on artificial media.

By this method we have also obtained homogeneous suspensions for other serological tests, for physiological studies, and for animal inoculation. Erythrocytes treated with liquid nitrogen were completely lysed, and from such cells large quantities of stromata could be obtained by centrifugation.

The rapid evaporation, the low temperature, and the chemical inertness of liquid nitrogen make it a valuable agent for producing homogeneous suspensions of bacteria.

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Free Selection of Nutrients by Hereditarily Obese Mice

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The production of a strain of mice throwing animals that show hereditary obesity has been recently described (*1*). It may be useful to recall that they originated from the crossing of "V stock" males to offspring of "V stock" males and "C57BL/6" females. The strain (Ob ob) throwing obese animals presents a variety of characteristics corresponding to V stock genes: "nonagouti," "leaden," "piebald spotting," "waltzing," and "waved-1," as well as the "fuzzy" gene.

Very marked differences in weight between "obese" and "nonobese" members of this strain are soon apparent. For example, young adult obese mice weigh 38–56 g, whereas the weights of young adult nonobese mice are in the 16–26-g range.

In order to discover a lead to possible nutritional and metabolic abnormalities associated with this hereditary obesity, a free-selection experiment was instituted, using 10 obese and 7 nonobese animals. The animals were placed in individual screen-bottomed cages at constant temperature and humidity. They received three "diets," I, II, and III, representing essentially pure fat, carbohydrate, and protein fortified with minerals and vitamins. Diet I consisted of casein, 75%; dried defatted liver powder, 15% (representing 90% of the total calories as protein); corn oil, 5%; cod liver oil, 1%; salt 4%. Diet II consisted of sucrose, 90% (representing 90% of the total calories as carbohydrate); corn oil, 5%; cod liver oil, 1%; salt, 4%. Diet III consisted of lard, 57%; corn oil, 15%; cod liver oil, 2% (representing 90% of the total calories as fat); casein, 15.5%; dried defatted liver powder, 3.0%; salt, 7.5% (*2*). In addition, the following vitamins were added to all

[1] The portion of the work done in the Department of Nutrition, Harvard School of Public Health, was supported in part by grants-in-aid from the National Heart Institute, of the National Institutes of Health, USPHS; the Milbank Memorial Fund, New York; and the Nutrition Foundation, Inc., New York. The portion of the work done at the Roscoe B. Jackson Memorial Laboratory has been aided by a grant from the National Cancer Institute.

TABLE 1

GRAMS OF DIETS I, II, AND III EATEN BY OBESE AND NONOBESE MICE

Obese animals			Nonobese animals		
Diet I (high protein)	Diet II (high carbohydrate)	Diet III (high fat)	Diet I (high protein)	Diet II (high carbohydrate)	Diet III (high fat)
1.12 ± 0.555*	1.96 ± 0.644	1.73 ± 0.379	1.42 ± 0.634	2.49 ± 0.828	0.56 ± 0.396

* The figures following ± signs represent standard deviations.

TABLE 2

DAILY AVERAGE TOTAL CALORIES CONSUMED AND PERCENTAGES DERIVED FROM PROTEIN, CARBOHYDRATE, AND FAT BY OBESE AND NONOBESE MICE

Obese animals				Nonobese animals			
Total cal	Protein	Carbohydrate	Fat	Total cal	Protein	Carbohydrate	Fat
25.48 ± 5.31*	19.98 ± 4.08	27.80 ± 8.30	52.22 ± 6.59	20.44 ± 4.37	26.40 ± 9.17	44.81 ± 16.1	28.78 ± 8.35

* The figures after the ± signs represent standard deviations.

three diets in proper amounts: choline, thiamine, pyridoxine, riboflavin, niacin, calcium pantothenate, *p*-aminobenzoic acid, α-tocopherol, and inositol. These diets were placed in separate 10-cc beakers disposed on the inside of V-shaped racks, with a slit opening allowing the animals to eat but preventing them from either spilling or contaminating the diet. Food and water were given *ad lib.* Food cups were weighed daily. The animals were on experiment an average of 18 days. The results, in grams, of diets I, II, and III eaten by obese and nonobese animals daily, as well as total average daily food intakes, are given in Table 1. Total daily calories, as well as percentage derived from carbohydrate, protein, and fat, are given in Table 2.

It will immediately be apparent that very marked differences were found between obese and nonobese animals. First, evidently, obese animals ate significantly more than nonobese animals ($P = 0.03$). Although the average difference of 5 cal/day between obese and nonobese animals may not appear sufficient to account for the differences in weight observed, it may be useful to recall that in 30 days a difference of 5 cal daily, with a maximum thermochemical efficiency of 24% (*3*), could represent up to 4 g of depot fat alone. If the difference in body composition comprises proteins and associated water, the difference in body weight could in theory run up to four times this value. Second, there were equally marked differences in the proportion of the calories derived from fat, protein, and carbohydrates. The obese animals ate proportionately more fat ($P < 0.0001$), less protein ($P = 0.03$), and less carbohydrate ($P = 0.007$) than the nonobese animals, with the differences in fat and carbohydrate particularly striking. These in turn led to two important considerations. First, the increase in fat and decrease in carbohydrate intake could be easily correlated with the "glucostatic" theory of the regulation of food intake (*4*). Second, the type of diet selected by the obese animals was reminiscent of diets restricted in carbohydrate often used in the dietary management of diabetes. Both suggestions have been actively explored, and the question of diabetes is considered in another note published in this journal.

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Hereditary Diabetes in Genetically Obese Mice

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The preceding note (*1*) has described the development of a strain of mice presenting a high proportion of hereditarily obese animals and their genetic constitution. It has been shown how the obese animals, placed on a "free-choice" diet, chose a "diabeticlike" regimen, whereas the nonobese animals chose a more normal distribution of nutrients. These results led to an investigation of the carbohydrate metabolism of these animals. It may be indicated at the outset that such a study presented special difficulties on two counts. First, this being a new strain of mice, experimental animals are still produced in limited numbers; second, glucose determinations by the Somogyi-Nelson

[1] The portion of the work done in the Department of Nutrition, Harvard School of Public Health, was supported in part by grants-in-aid from the National Heart Institute, of the National Institutes of Health, USPHS; the Milbank Memorial Fund, New York; and the Nutrition Foundation, Inc., New York. The portion of the work done at the Roscoe B. Jackson Memorial Laboratory has been aided by a grant from the National Cancer Institute.

TABLE 1

BLOOD SUGAR LEVELS

Obese mice				Nonobese mice			
Normal	Fasting	400 IU/kg insulin	20 IU/kg insulin	Normal	Fasting	400 IU/kg insulin	20 IU/kg insulin
197	148	231	273	79	125	Lethal	Lethal
	88	224	318	141	112	"	"
291	119		298	88			
155				127			
217							

method necessitate individual blood samples of 0.2 or 0.4 ml for duplicate determinations (*2, 3*). Such amounts can be taken safely from mice only once every three weeks, which seriously limits experimental possibilities. Urine collections, although presenting no special difficulties per se, are made more delicate by the small size of the samples.

A study was made of blood glucose levels of obese and nonobese animals under various experimental conditions, as well as of normal urine glucose levels. The animals used were housed in individual, screen-bottomed cages and fed water and pellets *ad lib*. The results are given in Table 1 on an individual basis because of the limited number of animals used. The figures demonstrate that fed obese animals have a high blood sugar level (generally above 200 mg%) whereas nonobese animals presented a blood sugar level of the order of 110 mg. The effect of fasting was next studied—a 4-hr period was used. It is evident from the results that the blood sugar level of obese animals is much more sensitive to fasting than that of the nonobese animals, as it drops 50–60%, whereas that of the nonobese animals does not change appreciably during this interval. This result, incidentally, is in agreement with the "glucostatic" scheme of the regulation of food intake, which sees food intake conditioned by the *variations* in the blood glucose level (*4*). More remarkable, it was found that all obese animals belonging to this strain were insulin-resistant. High (20 IU/kg) and massive (400 IU/kg) doses of insulin ("Iletin," Lilly) were administered to the obese animals. No convulsions or deaths were observed with those doses. The blood sugar levels 1 hr after injection are recorded in Table 1. The obese, diabetic mice were found to be as a rule totally unaffected, and conserved extremely high blood sugar on doses that would kill normal animals in a short time. On the other hand, the nonobese mice present a normal insulin sensitivity. Obese and nonobese animals seem to be quite responsive to the administration of epinephrine. Blood sugar values 1 hr after administration of 1 mg/kg of adrenaline were of the order of 500 mg%.

Obese animals normally present a glucosuria of the order of 3 g%.

These observations lead to the following important conclusions: First, for the first time the existence of hereditary diabetes, clearly independent of environmental influences, has been established. Second, an obvious link between pathology of carbohydrate regulation and obesity is evidenced in these animals. They thus furnished a striking illustration to the glucostatic theory of the mechanism of the regulation of food intake. Finally, these animals are useful subjects for the elucidation of insulin-resistant diabetes. Metabolic and biochemical studies are being continued.

Histological and pathological data concerning obese and nonobese animals will be published in the near future (*5*). Three results may be stated already: first, both obese and nonobese animals generally present enlarged islets of Langerhans; second, as compared to other strains, the liver of obese animals is characterized by an abnormally low glycogen content, and the liver of nonobese animals presents a definitely higher glycogen content; finally, obese mice frequently present ulcerative lesions not unlike the decubitus ulcers sometimes seen in obese diabetic humans.

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Significance of Endogenous Cholesterol in Arteriosclerosis: Synthesis in Arterial Tissue[1]

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Recent concepts of the pathogenesis of arteriosclerosis have stressed the importance of dietary cholesterol in the development of this lesion. Evidence that this sterol is synthesized by many tissues in the animal body is accumulating, however. The early balance experiments of Schoenheimer and Breusch (*1*) on mice fed cholesterol-free diets left no doubt that animals can synthesize cholesterol, and this conclusion has been amply confirmed in the isotopic studies of Bloch and his associates (*2, 3*). The latter demonstrated that surviving liver slices can convert acetate to cholesterol and, according to Srere *et al.* (*4, 5*), this conversion can also be carried out by the adrenal cortex, kidney, testes, small intestine, and skin. It thus becomes of some importance to evaluate the significance of this endogenously synthesized cholesterol in the development of atheromata. Experiments designed to do so are in progress in this laboratory. This paper reports the ability of the artery to synthesize cholesterol.

The chickens used were mature male White Leg-

[1] Aided by grants from the U. S. Public Health Service and the Life Insurance Medical Research Fund.

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horns and were obtained from the Poultry Division flock of this university. The rabbits were obtained on the open market and included both males and females.

The animals were sacrificed by cervical fracture. Following removal, the aortas were placed in a cold, oxygenated Krebs-bicarbonate buffer, and while there were rapidly freed of all adherent fat and connective tissue. They were then cut into sections approximately ½ cm long. These were blotted on filter paper, weighed, and incubated in 5 ml of Krebs-bicarbonate buffer containing 1 mg of doubly C^{14}-labeled acetate prepared by the method of Barker *et al.* The tissues were incubated for 3 hr at 37.5°, as described by Chernick *et al.* (*6*).

The tissue was removed from the flask and hydrolyzed on a steam bath with 2 ml of 90% KOH and 5 ml of 95% alcohol, for 6–12 hr. The fatty acids and cholesterol were precipitated by bringing the pH of the solution below 3 with 6*N* HCl. Precipitation was completed by allowing the flask to remain in an ice-box for several hours. The entire contents were then filtered (No. 1 Whatman paper), and the residue was washed with water acidified with HCl. Four additional acid-water washings were employed to remove most of the acetate from the lipids.

The residue on the filter paper was dissolved first with acetone, next with a mixture of acetone and ether (1:1), and finally with ethyl ether. The dissolved

TABLE 1

CONVERSION OF C^{14}-ACETATE TO CHOLESTEROL AND CO_2 BY ARTERIAL TISSUE

Expt. No.	Flask No.	Tissue		C^{14}-acetate added to flask (cpm)	C^{14} recovered as CO_2/g wet tissue (%)	Specific activity of isolated cholesterol*
		Type	Wet wt (mg)			
1 (Rabbit)	1	Aorta	430	1.0×10^6	2.8	32
	2	"	330	1.0×10^6	3.8	34
	3	"	525	1.0×10^6	1.7	19
	4	"	200	1.0×10^6	2.8	15
	5	"	415	1.0×10^6	1.9	76
	6	"	555	1.0×10^6	1.6	36
	7	"	348	1.0×10^6	4.3	43
	8	Liver	515	1.0×10^6	13.0	1.3×10^4
2 (Rabbit)	1	Aorta	684	1.5×10^6	3.1	28
	2	"	495	1.5×10^6	7.1	23
	3	Liver	535	1.5×10^6	15	1.3×10^4
	4	"	535	1.5×10^6	12	1.9×10^4
3 (Chicken)	1	Aorta	545	$.92 \times 10^6$	3.7	160
	2	"	563	$.92 \times 10^6$	5.2	84
	3	"	590	$.92 \times 10^6$	5.3	110
	4	"	477	$.92 \times 10^6$	2.4	54
	5	"	630	$.92 \times 10^6$	7.2	420
	6	"	213	$.92 \times 10^6$	3.8	27
	7	Liver	504	$.18 \times 10^6$	37	1.5×10^3
	8	"	504	$.18 \times 10^6$	38	1.6×10^3
	9	Boiled aorta	467	$.92 \times 10^6$	—	1
	10	" "	510	$.92 \times 10^6$	—	3
4 (Chicken)	1	Aorta	676	$.45 \times 10^6$	3.8	60
	2	"	678	$.45 \times 10^6$	3.7	110
	3	Liver	501	$.45 \times 10^6$	51	5.3×10^3
	4	"	497	$.45 \times 10^6$	52	5.4×10^3
	5	Boiled liver	488	$.45 \times 10^6$	0.10	0
	6	" "	488	$.45 \times 10^6$	0.00	0
5 (Chicken)	1	Aorta	543	1.0×10^6	2.9	69
	2	"	501	1.0×10^6	3.6	37
	3	"	479	1.0×10^6	6.7	71
	4	Liver	503	1.0×10^6	41	2.6×10^3
	5	"	504	1.0×10^6	39	2.5×10^3
	6	Boiled liver	501	$.50 \times 10^6$	0.05	4

* Specific activity refers to cpm/mg cholesterol isolated, corrected for an acetate activity of 10^6 counts. Each flask contained 1 mg sodium acetate.

As a rule, arterial tissue obtained from a single animal (200–680 mg) was incubated in each flask. In the case of each experiment, a run was also made with liver slices. At the end of the 3-hr incubation period, the CO_2 evolved was trapped in KOH, and its C^{14} content was determined as described by Chernick *et al.* (*6*).

fatty acids and cholesterol were collected in a 250-cc Erlenmeyer flask equipped with a closed side arm. The solvents were evaporated on the steam bath, 3–5 ml of acidified water was then added, and the lipids in the resulting suspension were extracted three times with boiling petroleum ether. The petroleum ether solutions were transferred to a 50-cc Erlenmeyer flask, the side

arm on the 250-cc Erlenmeyer flask serving to trap the water during these transfers. After the petroleum ether was boiled off, the lipids were dissolved in 5 ml of a 1:1 mixture of acetone and alcohol, and to this was added 2 ml of a 0.5% digitonin solution in 50% alcohol. The cholesterol digitonide was allowed to precipitate overnight at room temperature and was then filtered through No. 50 Whatman filter paper. The fatty acids and other contaminants were washed off the digitonide, first with a 1:1 acetone-ether mixture and then three times with ethyl ether. While some ether still remained in the digitonide boiling distilled water was poured over it. This caused the platelike precipitate to break up, and the hot water dissolved any digitonin precipitated by the first acetone-ether wash. An acetone-ether (1:1) wash followed by an ethyl ether wash served both to dry the digitonide and to force it to the bottom of the filter paper. The funnel containing the filter paper was next placed in a vacuum oven at 50° C for 30 min. The dried digitonide was carefully transferred to a Van Slyke microcombustion apparatus (*7*), oxidized, and its C^{14} counted as $BaCO_3$. The specific activity was calculated as epm/mg cholesterol.

Conversion of acetate to CO_2. It is apparent from the results shown in Table 1 that rabbit and chicken arteries can convert considerable quantities of acetate to CO_2. The amounts of arterial tissue added to each bath were not kept constant, and for this reason the percentages of the added C^{14} converted to CO_2 are recorded for 1 g wet tissue. The capacity of arterial tissues to oxidize acetate to CO_2 ranged from 6 to 60% of that found for corresponding livers.

Incorporation of acetate-C^{14} into cholesterol. The aortas of rabbits and chickens show a small but consistent ability to synthesize cholesterol. The specific activities of the cholesterol isolated after a 3-hr period of incubation ranged from 15 to 420 epm/mg cholesterol. Since it is not possible to prepare uniform sheets of whole arterial tissue, a comparison of the results of the various runs is perhaps not indicated. It should be noted, however, that the highest specific activity of cholesterol obtained with arterial tissues was about one fourth that observed with liver slices.

Liver slices and arterial tissue that had been immersed in boiling water for 5 min were incubated in the presence of C^{14}-labeled acetate for 3 hr. The results of these experiments are also recorded in Table 1. The recoveries of the C^{14} as CO_2 and cholesterol in these experiments were negligible. This indicates that the values obtained with surviving tissues were not the result of gross bacterial contamination of the incubation mixture nor of contamination of the isolated cholesterol with the labeled acetate.

Until recently the view was widely held that changes in chemical composition of arterial tissue are, in large part, a reflection of its plasma environment, and this belief has been carried over to nearly all concepts of atherogenesis. However, it has been pointed out elsewhere (*8*), on the basis of Q_{O_2} measurements, that the artery cannot be considered totally passive. This conclusion is further emphasized by the findings reported here. It is demonstrated that the aorta has the capacity for oxidizing significant amounts of acetate to CO_2. Indeed, its capacity to do so under our experimental conditions reached 60% of that of the liver.

But metabolism in arterial tissue is not restricted to catabolic processes. That it also engages in synthetic reactions was shown earlier for phospholipides and fatty acids (*9*) and is again demonstrated here in the case of the conversion of acetate to cholesterol.

Cholesterol synthesis by the artery, it should be noted, is but one phase of a rather widespread reaction, which probably occurs throughout the animal body. The importance of this extradietary cholesterol in the pathogenesis of atherosclerosis in man remains to be evaluated.

That dietary cholesterol is involved in pathogenesis of arteriosclerosis is no longer doubted. The conclusion, however, that endogenous cholesterol *can* also be important in arterial degeneration is forced upon us by the demonstration that the chicken injected with stilbestrol develops hypercholesterolemia promptly, and atherosclerosis in about a year, even when the diet fed during this entire period is practically devoid of cholesterol (*10, 11*).

Cholesterol-bearing lipoproteins have recently been shown by Gofman and his associates to be correlated with excessive atherosclerosis in man (*12*). This fraction can be made to appear in plasma of man by the feeding of high-fat, high-cholesterol diets. It is of interest to report that this fraction also appears in the serum of stilbestrol-treated birds fed a low-cholesterol diet.[3] It is thus clear that synthesized cholesterol *can* be made to play a decisive role in the development of experimental atherosclerosis.

Our finding that the artery is capable of synthesizing cholesterol, coupled with the observations on the stilbestrol-treated bird, indicates that endogenous cholesterol, originating within the artery itself and elsewhere in the body, may be of greater importance in the pathogenesis of spontaneous arteriosclerosis than has hitherto been supposed.

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[3] These studies are being carried out with J. Gofman.

A Modification of the Schleicher Technique for Detecting the "Erythrocyte Aggregation Factor" in Serum

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The "erythrocyte aggregation factor" in the plasma and serum of patients with acute lupus erythematosus demonstrated by Schleicher (*1*) could be detected by using a cold conglutination technique. In the sera of 17 out of 17 patients with the acute form of the disease this factor was present. Further, it could be shown that the EAF is present in clinical entities other than lupus erythematosus. It is of interest that strongly positive sera also gave positive liver function tests (Table 1).

The standard routine conglutination technique as used for blood crossmatching was employed for the demonstration of the erythrocyte aggregation factor. Commercial bovine albumin[2] was used in place of fresh egg white. The sodium chloride diluent was also omitted except in making the red blood cell suspension. The cold conglutination test is done as follows: In a Wassermann test tube are placed 3 drops of commercial albumin, 2 drops of the test serum, and 2 drops of a 10% washed red blood cell suspension in saline. The erythrocytes should be washed three times in saline before using them for the test. Group "O" Rh-positive red blood cells or the patient's cells can be used. The test is refrigerated for 2–24 hr. Immediately upon removal from the refrigerator, the test is centrifuged at 2,000 rpm for 1 min and read macroscopically as a cold agglutination test.

Controls should be run simultaneously, since clumping of erythrocytes may occur in negative sera. In a negative test, however, the cell clumps are easily broken up by gentle shaking. The clumping phenomenon in positive sera disappears at room temperature, but reappears when the test is placed in the refrigerator for 2–24 hr. Strongly positive sera caused clumping of the red blood cells in serum dilutions of 1:8 or 1:16. Sterile sera that gave a strong positive test gave a weak positive test when kept at room or refrigerator temperature for several days. Sterile negative serum incubated with *Staphylococcus aureus* or *Escherichia coli* cultures for 12 hr failed to produce a positive test, but in some instances a positive cephalin flocculation test resulted.

TABLE 1

RESULTS OF COLD CONGLUTINATION TEST IN ACUTE LUPUS ERYTHEMATOSUS AND OTHER CLINICAL CONDITIONS CORRELATED WITH LIVER FUNCTION TESTS

Patient	Diagnosis	Cold conglutination	Thymol turbidity	Cephalin flocculation, 48 hr
1	Lupus Erythematosus	Positive	Not done	Not done
2	" "	"	4	4+
3	" "	"	10	±
4	" "	"	10	4+
5	" "	"	6	Negative
6	Scleroderma?	"	10	4+
7	*E. coli* cystitis	"	10	4+
8	" "	"	10	4+
9	" "	"	9	3+
10*	" septicemia	"	Negative	Negative
11†	" "	"	Not done	Not done
12‡	Macrocytic hemolytic anemia	Weak positive	5	4+
13	Asthma (undetermined)	Positive	6	4+
14	Pneumonia (viral?)	"	7.5	Negative
15	Fracture of femur	"	5	3+
16	Rheumatic fever?	"	Negative	2+
17	Undiagnosed	"	7	3+
18	*Staphylococcus*, monilia infection	Negative	4	Negative
19	Infectious mononucleosis	"	Negative	±
20	Acute lymphatic leukemia	"	"	1+
21	Syphilis (Kline positive)	"	4	Negative
22	Streptococcal septicemia	"		
23§	*Staph. aureus* septicemia	"		
24§	" " "	"		
25	Hemolytic streptococcal septicemia	"		
26–200	Normal sera	"		

* 8% bromsulphalein retention.
† With methemoglobin.
‡ Methemoglobin.
§ Hemolytic, coagulase positive.

Since this report is of a preliminary nature, no correlation is attempted between the cold agglutination phenomenon and positive liver function tests. Studies are in progress to identify the factor causing the clumping of erythrocytes.

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The Use of Potassium Gluconate in Hypopotassemia

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The approach to the problem of hypopotassemia has been greatly simplified by the development of the flame photometer. Hypopotassemia has been found in diabetic acidosis, infantile diarrhea, and after major surgical operations. The prompt administration of potassium has been found to be extremely beneficial when such insufficiencies have been shown to exist.

The ideal substance for the administration of potassium would be a salt in which the anion of the compound exerts slight or no pharmacological action. Compounds of this nature would be the metallic salts of gluconic acid. The parent radical of this group of salts, gluconic acid, is chemically a penta-hydroxy caproic acid, which is derived by oxidation of the aldehyde group in the sugar D-glucose. Gluconic acid does not display any marked physiological action, and it has been shown that gluconic acid is tolerated without injury or disturbance to the digestive system. The radical is also of relatively low toxicity upon parenteral injection. One of these compounds, calcium gluconate, has been successfully employed during the past 20 years in the treatment of tetany and other calcium deficiencies.

This communication reports the use of another gluconate, the potassium salt, in hypopotassemia, and its method of preparation. Potassium gluconate[1] is a white crystalline powder having a mol wt of 234.24, and containing 16.7% potassium. It has a mild saline taste, is quite soluble in water, and is stable in air. A 30% solution of potassium gluconate is prepared with pyrogen-free triple-distilled water, filtered through a fritted Pyrex glass disk, transferred to 20-ml size ampules, and autoclaved.[2] Twenty ml of this solution contains 1 g of potassium (25.5 mEq). The solution has a pH of 7.0 and is colorless and stable. It may be added to the usual parenteral infusion mixtures. Although the usual source of potassium for both oral and parenteral administration has been potassium chloride, the gluconate is the solution of choice when the chloride ion is undesirable.

Potassium gluconate may be given orally in orange juice, Coca-Cola, tea, etc. One g of potassium gluconate is equivalent to 167 mg or 4.2 mEq of potassium. Parker (*1*) has shown that the gluconate when given orally seems to be less irritating than the chloride, and is well tolerated.

Potassium gluconate has been used as a source of potassium in hypopotassemia in the surgical and medical wards of the Lenox Hill Hospital for the past 6 months with excellent results. A more detailed report will be submitted at a later date.

[1] Potassium gluconate through the courtesy of Chas. Pfizer & Co., Brooklyn, N. Y.

[2] We are indebted to Samuel Gordon, Endo Products, Richmond Hill, N. Y., for supplying ampules of potassium gluconate.

Reference

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Tetrazolium Salt

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2,3,5-Triphenyl tetrazolium chloride, commonly known as tetrazolium salt, or TTC, was first prepared by von Pechmann and Runge (*1*) in 1894. It occurs as a white to pale-yellow crystalline powder that darkens on exposure to light. The reasons for this color change have been investigated by Weygand and Frank (*2*), and further by Hausser, Jerchel, and Kuhn (*3*). It is readily soluble in water, and melts with decomposition at about 245° C.

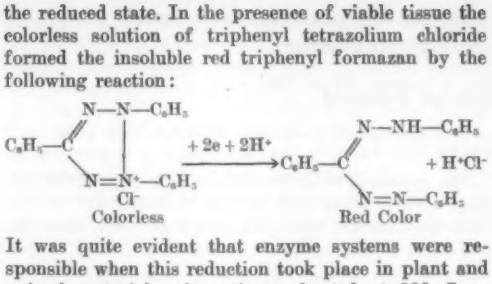
In 1941, Kuhn and Jerchel (*4*) synthesized a number of substituted tetrazolium salts by an improved procedure and called attention to the fact that their dilute solutions stained yeast, garden cress, and bacteria. They found that the reduction of the colorless salt solutions to red compounds that dyed the plant tissues was not due to the presence of glutathione, ascorbic acid, or cysteine, for the latter substances did not reduce these salts below a pH of 9.0, whereas the characteristic reductions observed on yeast, garden cress, and bacteria took place in neutral solutions.

As a result of various studies, Lakon (*5*) substituted triphenyl tetrazolium chloride for the toxic compound sodium selenite in his "topographic method" for testing the germinating ability of seeds. By a comprehensive series of comparative staining and germination tests, he was able to show that it was possible to predict the germinability of corn, oats, rye, wheat, and barley by observation of the embryo parts that were stained red by the insoluble formazan deposited in viable tissues.

Nadvornik (*6*), using Lakon's method, found that results concordant with those obtained by germination and superior to those given with selenite could be obtained with seeds of shrubs and fruit trees. Porter, Durrell, and Romm (*7*) used the method and found a close agreement between the percentage of stained embryos and the percentage of normal sprouts obtained in standard germination tests with corn, wheat, rice, buckwheat, popcorn, soybeans, and Bahia grass. Less satisfactory agreement was found in a comparison of the two methods when applied to vetch and to some lots of oats, peas, and barley. Cottrell (*8*) found good agreement between results obtained with the tetrazolium salt test and those obtained by the standard germination tests; the results were within the legal requirements for accuracy for cereal seed testing. Bishop (*9*) has discussed its use in the evaluation of malting barley. Shuel (*10*) reported that new barley, oats, and wheat incubated in a 1% solution at

48° C gave a good color reaction, which appeared to be a quick, reliable index of germinability, but for old seeds with a viability of less than 60% the test was much less accurate. Goodsell (*11*) introduced into the staining technique drying of the seed at 43° C to 12% or less moisture. In a second paper, Cottrell (*12*) reported that wheat, barley, oats, peas, and vetches gave results as reliable as those obtained in standard germination tests, but found small seeds difficult to examine. However, Flemion and Poole (*13*), in another paper published at about the same time, stated that they found great difficulty in interpreting the staining in testing the seed viability of many species, but their trial did not include any cereals. Bennett and Loomis (*14*) found that freezing injury in seed corn could be determined with fair accuracy by staining with a 0.05% solution, provided viability was fairly high and the corn had been stored for a period after freezing. Further reports on seed viability tests have been given by Lakon (*15*) and Crocioni (*16*). In the first of a promised series of papers on methods of adapting the tetrazolium method to the determination of the viability of small seeds, Hyde (*17*) reported work with Chewing's fescue (*Festuca rubra*). Holmes (*18*) found that with the seeds of conifers the tetrazolium method gave a fairly constant overestimate of the actual figure found by germination tests. Raggio and de Raggio (*19*) obtained satisfactory results using a 0.1% solution with seeds of the following species: *Pinus, Quercus, Laurus, Ricinus, Phaseolus, Vigna, Sesbania, Gossypium, Hibiscus, Lycopersicum, Solanum, Citrullus, Cucumis,* and *Helianthus*. In three further papers, Lakon (*20*) has given the detailed technique to be followed in determining the viability of peas and conifers. In a comparison of the dinitrobenzene, selenite, and tetrazolium methods, which are described and compared with physiological methods, Fink and Schwieger (*21*) concluded that, although more rapid, the new methods did not differentiate between germinating energy and germinating power. Brewer (*22*) reported its use in estimating damage in artificially cured peanuts.

Mattson, Jensen, and Dutcher (*23*) confirmed the work of Lakon with seed corn and the observations of Kuhn and Jerchel with yeast. They found that many other viable materials, in addition to seeds and yeast, reduce neutral solutions of tetrazolium salt: the fleshy parts of apples, oranges, and grapes; the gill area of mushrooms; carrot roots; white and sweet potatoes; young leaves; the stigmas and ovaries of certain pollinated flowers; bull spermatozoa; and the blastoderm of hen's eggs. The serum of bull spermatozoa and the chalazae of egg white gave a positive reaction. The reduction of the tetrazolium salt was not due to sugars, for reducing sugars formed the red formazan only above pH 11.0, whereas the above-mentioned materials would reduce the compound at acidities below pH 7.0. They stated that the use of tetrazolium salt should have a distinct advantage over many indicators as a viability test, since it was one of the comparatively few organic compounds that was colored in the reduced state. In the presence of viable tissue the colorless solution of triphenyl tetrazolium chloride formed the insoluble red triphenyl formazan by the following reaction:



It was quite evident that enzyme systems were responsible when this reduction took place in plant and animal materials, since tissues heated at 82° C or higher lost their ability to reduce this salt. Furthermore, it was probable that the reduction was caused by dehydrogenase systems requiring coenzymes I or II, for Jerchel and Mohle (*24*) had shown that the apparent redox potential of tetrazolium salt was about −0.08 v. Thus it was possible for the compound to act as an electron acceptor for many pyridine nucleotide dehydrogenases. They found that one of these holoenzymes, glucose dehydrogenase-coenzyme I, in the presence of its substrate, reduced the salt at pH 6.6, and other experiments had indicated that the enzyme systems responsible for the reduction of the tetrazolium salts were present in a wide variety of living tissues. They suggested that in all probability the reduction of these compounds by enzymes of living cells could not be considered a general test for life, but nevertheless the unusual properties of these reagents suggested that they might be utilized in many types of biological research involving differences in tissue viability. Their suggestions have now been followed up with some good results. Lederberg (*25*) reported some further experiments on its use with enzymatic reducing systems. Waugh (*26*) observed that sections of living trees and shrubs became stained in the cambium layer, whereas dead sections were unaffected; more recently, Roberts (*27*) has made a detailed survey of reducing tissues in vascular plants. Morse (*28*), in studies on the bleaching of vegetables, found that the system responsible for the reduction to formazan was one more easily inactivated by heat than either the catalase or peroxidase systems of vegetables.

Straus, Cheronis, and Straus (*29*) obtained successful results in the detection of malignant tumors by differential staining, the disadvantage being the fact that the red stain was difficult to distinguish, and Schuermann (*30*) found that, following application to ulcerated tissues *in vivo*, reduction took place relatively more rapidly with malignant tumors than with benign lesions. But when Seligman, Gofstein, and Rutenburg (*31*) examined the distribution of radio-iodine-labeled tetrazolium in mice, they found there were no great differences in the radioactivity of tumors and that of other tissues, and concluded that neoplasms did not reduce the salt; this was confirmed by Masouredis, Shimkin, McMillan, and Fox (*32*), who found that following intravenous injection in mice radioactivity rapidly disappeared from the circu-

lating blood and was rapidly excreted by the liver and kidneys; transplantable mammary carcinoma and lymphoma were found to contain less radioactivity than most normal tissues. These conflicting results are difficult to interpret, but as may be seen from a paper by Wrenn, Good, and Handler (*33*), certain dyes are known to penetrate altered tissues, and it may become practice to detect neoplasms preoperatively by means of isotope-labeled dyes.

Gall (*34*) used tetrazolium salt to estimate the reducing activity of bean tissue cultured in the plant-growth substance 2,4-dichlorophenoxyacetic acid. Pratt, Dufrenoy, and Pickering (*35*) found it a valuable reagent in studies of cellular physiology, which could also be used in pencillin assays with *Staph. aureus,* and in another paper, Dufrenoy and Pratt (*36*) reported its use in testing the reducing activity of sugar-cane stalks. Later, Tynen and Underhill (*37*) reported its utility in the histological demonstration of subcutaneous fat, and Gunz (*38*) reported on its rapid reduction by fresh brewers yeast; he also obtained reduction with a cell-free yeast extract, but heating the yeast or the extract to 60° C inhibited the reaction. Fred and Knight (*39*) reported on its reduction by *Penicillium chrysogen,* Black and Kleiner (*40*) on its use in the measurement of respiration of tissue slices, and Kun and Abood (*41*) on its use in the colorimetric estimation of succinic dehydrogenase. Mixner (*42*) showed that its use as a test for the viability of bull spermatozoa was precluded by its toxicity to the spermatozoa and its inability to stain adequately. Stein and Gerarde (*43*) later reported that it failed to indicate cell viability of chick-heart fibroblasts *in vitro,* presumably owing to the failure of the compound to penetrate living cellular membranes. Fults, Schaal, and Michaelson (*44*) reported a study of the tetrazolium salt reactions of 42 physiologic races of the common potato scab organism *Actinomyces scabies*; although there was no absolute correlation between parasitism on Bliss Triumph potatoes and the tetrazolium reaction, the parasitic races gave a significantly greater mean reaction than the non-parasitic types. Differentiation of bacterial species and variations within species were reported by Huddleson and Baltzer (*45*); 0.01% or less of tetrazolium salt was incorporated in agar and plated in Petri dishes, and differences were seen in the size, shape, and shade of the red central areas, with pronounced differences in the delicate pastel tints in the borders. Bielig, Kausche, and Haardick (*46*) investigated formazan formation at reducing loci in bacteria with varying conditions of pH and temperature, and at the same time Bielig and Querner (*47*) showed that it could be used in growth studies with marine animals, a 0.1% solution in sea water being nontoxic to a large number of species. Sonnenblick, Antopol, and Goldman (*48*) have reported some interesting findings on its influence on the growth and cytology of root tips of onions. An excellent review in Spanish of the uses and action of tetrazolium salts has recently been given by Raggio and de Raggio (*49*).

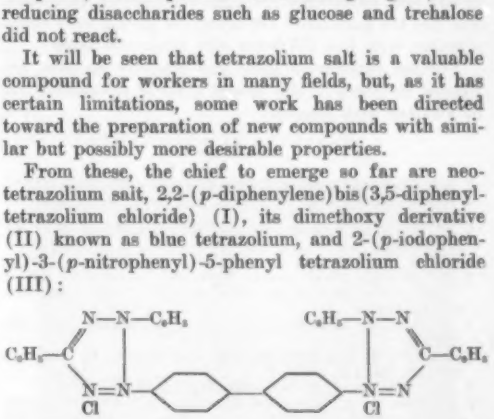
Weiner (*50*) has reported it to be a qualitative test for chemicals which are reducing compounds, the method employed being as follows:

To 2 drops or a few crystals of the unknown compound, 1 ml of water was added (or if insoluble in water, isopropyl alcohol was used). Four drops of normal sodium hydroxide followed by 4 drops of a 0.1% aqueous solution of tetrazolium salt was added, and the mixture allowed to stand for several minutes after shaking. A reddish precipitate (or solution if isopropyl alcohol was used) formed if a reducing substance was present.

Recently, Mattson and Jensen (*51*) reported its use in the quantitative colorimetric determination of reducing sugars at 4,900 A, and Trevelyan, Procter, and Harrison (*52*) have since reported its use in the detection of these sugars on paper chromatograms. The dried, developed paper chromatogram strip was treated with a 0.5% solution in chloroform, and after it had been allowed to dry it was sprayed with alcoholic sodium hydroxide. Red spots developed on standing overnight or on heating for 5 min in a moist atmosphere, in the presence of reducing sugars; non-reducing disaccharides such as glucose and trehalose did not react.

It will be seen that tetrazolium salt is a valuable compound for workers in many fields, but, as it has certain limitations, some work has been directed toward the preparation of new compounds with similar but possibly more desirable properties.

From these, the chief to emerge so far are neotetrazolium salt, 2,2-(*p*-diphenylene)bis(3,5-diphenyltetrazolium chloride) (I), its dimethoxy derivative (II) known as blue tetrazolium, and 2-(*p*-iodophenyl)-3-(*p*-nitrophenyl)-5-phenyl tetrazolium chloride (III):



(I)

(II)

(III)

Neotetrazolium salt gives a deep-purple to black color on reduction, as opposed to the red color given by tetrazolium salt itself, and is thus more easily distinguished in tissues. Antopol, Glaubach, and Goldman (*53*) reported that with fresh tissue slices, fibrous tissue stained little if at all, whereas muscle and

epithelial and parenchymal tissues such as liver and kidney stained well; malignant tumors stained rapidly and intensely. Its action on various bacteria and on onion root tips was also discussed. In another paper, the same authors (*54*) reported its use as a tool in the study of active cell processes, and Narahara, Quittner, Goldman, and Antopol (*55*) recorded its use in the study of *Escherichia coli* metabolism. For the test used on milk for the presence of brucellosis in cattle herds, Wood (*56*) has prepared a stable antigen for the *Brucella* ring test by the reduction of neotetrazolium salt.

Blue tetrazolium, which forms a deep-blue pigment on reduction, has been used by Rutenberg, Gofstein, and Seligman (*57*) to demonstrate enzymes in normal and neoplastic tissues, but it is ten times more toxic *in vivo* (mice) than tetrazolium salt itself; it has also been used in the histochemical demonstration of succinic dehydrogenase in tissue sections by Seligman and Rutenburg (*58*).

2-(*p*-Iodophenyl)-3-(*p*-nitrophenyl)-5-phenyl tetrazolium chloride recently reported by Atkinson, Melvin, and Fox (*59*), along with some other iododerivatives, is far less photosensitive than tetrazolium salt itself and has the additional advantage of giving very rapid staining with less diffusion into unstained tissue.

Further reports on these and possibly on new, improved members of this useful type of compound will be awaited with interest.

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Radioactive Tracers in Solid Solution Investigations

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During recent work on the exact freezing point of hydrogen peroxide we had to ascertain definitely whether this compound forms solid solutions with water. The experimental evidence reported previously in that connection (*1*) was considered doubtful, as it was based on an inadequate method, namely, direct analysis of phases. Indeed, the high viscosity of the solutions and the tendency of hydrogen peroxide to decompose on melting made it practically impossible to isolate completely the crystals from the mother liquor. On the other hand the so-called wet residue method of Schreinemakers (*2*) required addition of a third substance fairly soluble in both water and hydrogen peroxide, which did not catalyze decomposition of the latter or interfere with its chemical determination. It was further desirable that this substance

formed no solid solution or addition compound with the major constituents. Eventually it turned out that potassium chloride was suitable for that purpose, but in the meantime it occurred to us that the above difficulties could be removed or greatly minimized by using a radioactive tracer.

To this end radioactive phosphorus, P^{32}, in the form of potassium dihydrogen phosphate was chosen, as its type of activity was suited to the problem at hand. The peroxide solutions containing 0.025 mg tracer/l were partly frozen, and the bulk of the liquid was separated from the crystals by means of a filter stick. After warming to room temperature the activity of each phase was measured with a thin glass counter immersed in the liquid; the hydrogen peroxide content was determined from refractive index. The results obtained with a dilute (10%) and a concentrated (90%) solution indicated that the solid phase was pure ice and pure hydrogen peroxide, respectively. Further details on the experimental procedure and results will be published elsewhere (*3*).

Summing up, the use of a radioactive tracer offers the following advantages: minimum complications resulting from addition of a third component to the original system; no interference of the tracer with chemical analyses or measurements of some physical property of the solutions such as density, refractive index, etc.; only one component need be determined instead of two. This technique is equally applicable to the "synthetic" method of Bancroft (*4*) which requires no separation of phases. The results may be analyzed algebraically or graphically by plotting on rectangular coordinates activity against concentration of the component in greater proportion.

A number of years ago Terrey and Jolly (*5*) used natural radioelements to study the degree of hydration of certain salts. We feel that the availability of powerful artificial isotopes and the development of modern counting techniques add greatly to the interest and possibilities of this method.

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Comments and Communications

Touché!

In Science for May 11, 1951 (p. 543), in the article, "The Origins of American Scientists," by Robert H. Knapp and Hubert B. Goodrich, they list "the first fifty institutions with 30 or more annual graduates, ranked in order of their production index." The authors commented that "No Southern institutions appear here." Johns Hopkins University, Maryland, is nineteenth, and Charleston, South Carolina, twenty-ninth. I realize that Maryland, although below the Mason-Dixon Line, is sometimes felt to be a border state; but this is the first time that I had known that South Carolina was not considered a Southern state.

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Condensation Globules at Meteor Crater

The American Meteorite Museum, located on U. S. 66, 5 miles from Arizona's meteorite crater, has been making extensive and intensive studies of the adjacent soil. These studies have brought to light minute metallic globules that are believed to have been formed as condensation products from metallic vapors generated by the explosion of the colliding meteorite or meteorites.

Chemical analysis of these particles by F. G. Hawley[1] shows them to be about 17% nickel, and metallographic studies by A. W. Herbenar[1] prove the presence of cohenite, steadite, and schreibersite, as well as troilite. The percentage of nickel is about double that of the meteorite fragments found in the same area.

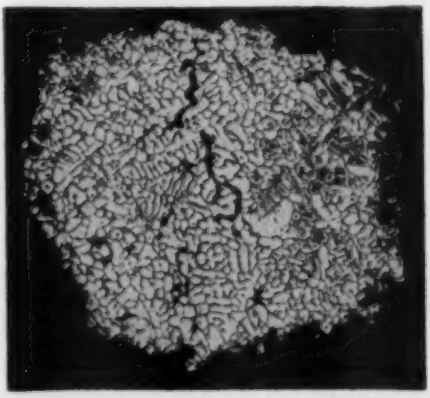

Fig. 1. Dendritic structure indicative of rapid cooling from liquid state. Black veinlike areas are oxide. The white dendrites are nickel-iron, and the gray filling between the lobes of the dendrites is sulfide, carbide, and phosphide more or less mixed. (×100.)

[1] We wish to express our thanks to F. G. Hawley for the chemical analysis, to A. W. Herbenar for his metallographic report, and to both Mr. Herbenar and Glenn E. Mills for photographs.

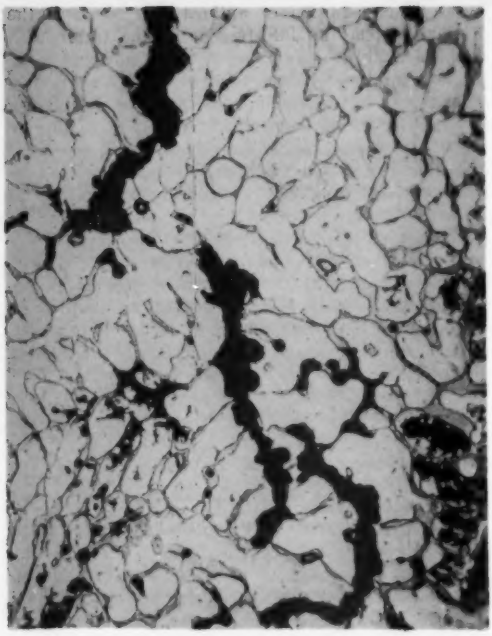

FIG. 2. Same as Fig. 1 but enlarged to 425 diameters. (Photos by A. W. Herbenar.)

The reason for this nickel-enrichment is still problematical.

Although these little objects have eluded fieldworkers for nearly 60 years, we have now proved that they exist in concentrations as high as 100 g/cu ft of topsoil. Such a concentration would amount to 3,000 tons/sq mi. Over how large an area this high concentration extends is not known, but it is thought to be rather limited. However, at least a sparse sprinkling of the material has been detected over 100 sq mi around the crater. Quantitative studies are now in progress.

Five different varieties of particles have so far been found, two of which are shown in Figs. 1 and 2. Microscopic studies have been made of the metallic spheroid variety only.

The theory of explosion of the meteorite was suggested during the very first years of exploration at the crater. But D. M. Barringer in 1909 thought he had amassed abundant evidence that such had not been its fate. He wrote:

> The evidence also is all against its having gone into a state of vapour at the moment of impact. In this connection it is only necessary to again point out that the absence of staining on a grand scale, in the depths of the crater and outside, is practically conclusive proof that the projectile did not either go into the form of vapour or of metallic mist upon impact, for a small amount of such metallic vapour or mist, so to speak, would have caused an immense amount of staining of the rock fragments and silica (paper read before Natl. Acad. Sci. U.S., Princeton Univ. [Nov. 16, 1909]).

The writer would like to point out that in no place, even where the particles are most abundant, is there any evidence of staining. The soil and ash from which we separate them is plain gray, and the silica almost white. Only where they lie on the reddish brown Moencopi formation is there any evidence of rust coloration, and here it is the natural color of the formation.

Absence of staining appears to be the result of an oxide coating formed on the little globules while they were still liquid, as the cloud came into contact with oxygen in the atmosphere. This coating was so impervious that, subsequent to its formation, the particles have evidenced little or no scaling. In this respect their present surfaces differ strikingly from the silvery metallic fragments of comparable size that are sometimes found with them.

A detailed study of these particles is now in progress.

H. H. NININGER

American Meteorite Museum
Winslow, Arizona

Erratum

WE FIND a correction is necessary in the last sentence on page 625 of our article entitled "An Analog of Vitamin B_{12}" (*Science*, 113, 625 [1951]).

In our original this sentence reads:

> The thiocyanate analog and vitamin B_{12a} when tested by the *L. lactic* (A) and the *L. leichmannii* "unprotected" (B) titrimetric assay methods (*6*) also respond in a like manner, distinct from vitamin B_{12}.

Please publish the following correction:

> The thiocyanate analog and vitamin B_{12a} when tested by the *L. lactis* (B) and the *L. leichmannii* "unprotected" (A) titrimetric assay methods (*6*) also respond in a like manner, distinct from vitamin B_{12}.

This will also necessitate the transposition of the headings "A" and "B" in Table 1 on page 626.

R. P. BUHS

Research & Development Division
Merck & Co., Inc.
Rahway, N. J.

News and Notes

Earth Science Institute

Herbert B. Nichols
U. S. Geological Survey, Washington, D. C.

THE SECOND ANNUAL CONFERENCE on "Earth Science in Secondary Education" was held in the auditorium of the School of Geography at Harvard University March 16–17, with about 100 representatives of colleges and secondary schools from eight states in attendance.

Sponsored by the American Geological Institute, of Washington, D. C., and the Earth Science Institute, of Boston, the conference discussed some of the difficulties experienced in teaching earth science in preparatory and high schools, particularly in areas where state and municipal boards hardly know with what the subject is concerned. Among the topics suggested for inclusion in an ideal secondary school course were the following: astronomy and the place of the earth in the solar system; moon and tides; the oceans; the lithosphere; the atmosphere; weather and climate; the carbon cycle; coal and oil; the hydrologic cycle; earth movements; fossils and earth history.

Opening the two-day sessions, Kirtley Mather, president of the AAAS and professor of geology at Harvard University, deplored the widespread lack of knowledge and appreciation of the earth's natural resources. Stressing the fact that every nation, including the U. S. and the Soviet Union, is short of several natural resources that modern civilization needs, he concluded that such shortages constitute one of the best reasons why all nations should join together in a cooperative "commonwealth of all mankind;" that there seems to be an explicit directive in the very structure of the earth that man should organize on a world basis.

Pointing out that earth science, which deals with the physical environment in which we live, is the most comprehensive and valuable science for the general education of a high-school graduate, David M. Delo, executive director of the American Geological Institute, enumerated some of the contributions of earth science to other disciplines. He indicated that knowledge of the basic materials and environmental conditions that support our national prosperity and industrial economy—particularly the role of soil, water, and minerals—should be a part of every citizen's education. "The physical environment and the geological processes which have created it," he stated, "form the stage upon which man's activities have been centered. We cannot understand the history and development of our country unless the role of these factors is made background material in the social sciences and related fields."

Ben Hur Wilson, of Joliet, Ill., described the earth science program in Joliet Township High School, now in its fiftieth year. Waldo Holcombe, of the Brooks School, North Andover, Mass., explained the development of the successful program in earth science that has been evolved during the past several years.

Stating that the U. S. Geological Survey can be of material assistance to educational institutions, Herbert B. Nichols, Survey information officer, analyzed its work and publications for the assembled educators. "The Geological Survey has a wealth of information to share with everyone," he said, "ranging from practical help for the farmer seeking water or for the tourist trying to comprehend American scenery to technical assistance for scientists, engineers, and industrialists."

Chester R. Longwell, of Yale University, author of widely used geological texts, discussed the offering of earth science in the secondary schools of Connecticut. He pointed out that courses in this subject had declined greatly during the past few decades and called for a resurgence of earth science teaching so that high-school graduates would gain a better understanding of the resources and history of their states. He offered special praise for the excellence of work performed in this field at Choate Preparatory School.

C. W. Wolfe, of Boston University, general chairman of the conference, stressed the need for additional meetings of this type and expressed satisfaction with the increasing interest that is being shown in earth science education. "This is particularly true in New York State," he stated, "where progressive state educational officials are encouraging more extensive offerings in this field."

A series of conferences similar to those in New England is being planned for other regions in 1952, notably New York and Pennsylvania.

Scientists in the News

Dale C. Cameron has been appointed chief of the Cooperative Health Services Branch of the PHS Division of Industrial Hygiene. He was formerly assistant director of the National Institute of Mental Health. **Seymour S. Kety**, of the University of Pennsylvania, will be scientific director for the joint research program of the Mental Health Institute and the new Neurological Diseases and Blindness Institute. Dr. Kety received the Theobald Smith Award for Research in Medical Sciences, given by the AAAS in 1949 for the first time in five years. Other new medical appointments are **Thomas B. Spencer** as executive director of the RDB Medical Sciences Committee, **Alfred H. Lawton** as research director of the Air Force Medical Department, and **Roy M. Scideman**, assigned to the AF Preventive Medicine Division; **Francis G. Blake** will serve on a part-time basis for the remainder of this year as civilian director of Army medical research, and **Harold E. Mann**, psychiatrist, has joined the Children's Bureau.

Lowell T. Coggeshall, dean of the Division of Biological Sciences, University of Chicago, has been appointed chairman of the Department of Defense Committee on Medical Science. Other members of the committee are: **Wallace O. Fenn**, University of Rochester; **Franklin C. McLean**, Chicago; **Douglas D. Bond**, Western Reserve; **I. S. Ravdin**, University of Pennsylvania; and the three surgeons general.

James B. Collip, dean and professor of medical research at the University of Western Ontario, received the Squibb $1,000 prize for glandular studies at the annual meeting of the Association for the Study of Internal Secretions. Dr. Collip is well known for his work on insulin and other hormones.

W. E. Cornatzer, of the Bowman Gray School of Medicine, has been appointed professor of biochemistry and head of the Department at the Medical School of the University of North Dakota.

Charles E. Dutchess, medical director, and **Sidney N. Sadoff**, engineering, have been elected vice presidents of Schenley Laboratories, Inc. Dr. Dutchess was also elected a director of Schenley Laboratories. He has been medical director since joining the company in 1944 and prior to that had been with Parke, Davis & Co. He is in charge of clinical investigation and professional relations and services. Mr. Sadoff joined Schenley Laboratories in 1946 as a special project engineer and was promoted to chief engineer in 1950.

New York Medical College and Flower–Fifth Avenue Hospitals have named **Clair E. Folsome** head of the Department of Obstetrics and Gynecology. Dr. Folsome helped set up maternal and child health clinics in Puerto Rico, Haiti, Singapore, Tokyo, Bombay, and Formosa. He was formerly vice president and executive director of research for the Ortho Research Foundation, executive director of the National Committee on Maternal Health, and consultant on obstetrics and gynecology for the Children's Bureau, Department of Labor.

Carnegie Corporation of New York has made grants-in-aid to a number of scholars from abroad for travel and study in the U. S. Among them are **F. William Fox**, biochemist, South African Institute for Medical Research; **H. Brian Low**, agricultural economist, Massey Agricultural College, New Zealand; **Arthur M. Hambly**, chemist, University of Melbourne; **P. W. Burbidge**, physicist, Auckland University College; and **A. K. Macbeth**, chemist, University of Adelaide.

The University of Wisconsin has conferred emeritus rank on the following professors: **James G. Fuller**, animal husbandry; **Andrew W. Hopkins**, agricultural journalism; **Gustus L. Larson**, mechanical engineering; **Wakelin McNeel**, county extension service; **James G. Milward**, horticulture; and **William H. Peterson**, biochemistry.

A. W. Gauger, director of the Mineral Industries Experiment Station, Pennsylvania State College, has been in Lima as a representative of the American Chemical Society at the Fifth South American Congress on Chemistry. Dr. Gauger also attended the celebration of the fourth centennial anniversary of the founding of the National University of San Marcos on May 12.

A. J. Goldforb, professor of biology, will retire this summer after 41 years on the faculty of The College of the City of New York. Since 1923 Professor Goldforb has been general secretary of the Society for Experimental Biology and Medicine, which has its offices at City College. Although he is retiring from active teaching at the mandatory age of 70, Dr. Goldforb will continue his work with the society.

LeVan Griffis, chairman of applied mechanics, has been named manager of a new engineering mechanics division at Armour Research Foundation. He will head three new departments: Structural Research, Mechanism and Propulsion Research, and Heat-Power Research. **E. H. Schulz** was appointed manager of a new physics and electrical engineering division. He has been chairman of electrical engineering and acting chairman of the Physics Department.

B. Groesbeck, Jr., MC, USN, and **Neely C. Mashburn**, MC, USAF (ret.), were the 1951 recipients of the Theodore Charles Lyster and Raymond Force Longacre Awards, respectively, of the Aero Medical Association. The Lyster Award for achievement in the general field of aviation medicine was given Admiral Groesbeck for his outstanding accomplishments in promoting and developing this specialty in the Navy, of which he is assistant chief, Bureau of Medicine and Surgery for Aviation and Operational Medicine. In addition, he was reelected vice president of the association. The Longacre Award was given Colonel Mashburn principally for his work in developing an apparatus for predicting flying aptitude in cadet applicants.

Frank T. Gucker, Jr., has been appointed dean of arts and sciences at Indiana University. Dr. Gucker has been chairman of Indiana's Department of Chemistry since 1947.

The Department of Geology, University of Kansas, has announced the appointment of **William W. Hambleton** and **John Imbrie** as assistant professors in geology.

Max Hansen has been named assistant chairman of the metals department of Armour Research Foundation. Dr. Hansen will continue his work in physical metallurgy. He joined the Foundation in 1949, and has been supervisor of projects dealing with nonferrous metals.

Omer W. Herrmann has been appointed by the Department of State to head the agricultural work at the American Embassy in Paris. He has been assistant administrator of the Agricultural Research Administration since 1947.

Einar Hille, professor of mathematics, Yale, has been elected a foreign member of the Swedish Academy of Science, Stockholm.

R. Palmer Howard, formerly demonstrator in medicine at McGill University, and in charge of the Endocrine Clinic and Laboratory of the Montreal General Hospital, has been appointed a member of the staff of the Oklahoma Medical Research Institute and Hospital. The Institute and Hospital are a private organization. Dr. Howard, who also will have an appointment as associate professor of research medicine in the University, is an endocrinologist known for his work on metabolic bone disease and gonadal hypofunction.

Sally Lucas Jean has retired from the National Foundation for Infantile Paralysis. Miss Jean has devoted half a century to health, creating the term "health education" in 1918 to replace what once was known in most school curricula as "hygiene." She has been health consultant and director of educational services for the foundation for the past eight years.

Donald R. Johnson, entomologist, of the Minnesota Department of Agriculture, Dairy and Food, with headquarters on the St. Paul campus of the University of Minnesota, will leave in July for Java, where he will advise Indonesians in three malaria research institutes and in local health organizations. The assignment is part of a joint USPHS–ECA project.

James M. Knox and **Carl W. Hedberg** have been made vice presidents of Research Corporation. Mr. Knox, the financial officer, will make his headquarters at the New York office. He has been business manager of Brookhaven National Laboratory since 1947, and assistant director during the past year. Mr. Hedberg will continue to be in charge of operations at the Bound Brook, N. J., plant. Mr. Hedberg has been with Research Corporation since 1916, when he joined the organization as a development engineer. He has been in charge of technical developments since 1927 and last year was made general manager of the Engineering and Construction Division.

A 1951 Horatio Alger Award has been presented by the American Schools and Colleges Association to **Finn Haakon Magnus**, of Newark, N. J., who arrived in this country 25 years ago with $25 in his pocket and worked his way up to the leadership of a multimillion-dollar industry, which he founded. The awards, made on the basis of ballots cast by more than 3,000 campus leaders in colleges and universities throughout the nation, are given annually to outstanding figures in commerce and industry who have achieved success after starting from the bottom. Former winners include Bernard M. Baruch, Charles Luckman, Charles E. Wilson, and Vincent Riggio. Other 1951 award winners included **David Sarnoff**, **Harold Stassen**, and **James L. Kraft**.

Linus Pauling, of Caltech, spent part of May and June in Hawaii, lecturing under the auspices of the local section of the American Chemical Society, the Hawaii chapter of the Society of the Sigma Xi, and the Chemistry Department of the University of Hawaii.

Robert B. Pettengill has been appointed director of discussion research of the Fund for Adult Education. Dr. Pettengill has been director of the Teaching Institute of Economics at the University of Southern California and for the past five years has been directing a program of adult education financed by the Alfred P. Sloan Foundation, Inc.

Samuel Cate Prescott, former dean of science at MIT, has been chosen as 1951 recipient of the Stephen M. Babcock award of the Institute of Food Technologists. This award, which includes a cash prize of $1,000 contributed by the Nutrition Foundation, Inc., is made annually for contributions in the field of food technology resulting in improved public health.

The Memorial Center for Cancer and Allied Diseases has named **Henry Thomas Randall** clinical director and chief of surgical services. Dr. Randall now is assistant professor of Surgery at the College of Physicians and Surgeons, Columbia University; assistant attending surgeon, the Presbyterian Hospital; and assistant visiting surgeon, Francis Delafield Hospital.

Charles E. Renn, associate professor of sanitary engineering at The Johns Hopkins University, has been appointed to a full professorship. Dr. Renn came to Johns Hopkins in 1946 to head new sanitary engineering laboratories designed for investigation of water supplies, sewage disposal, stream pollution abatement, and industrial waste treatment. In April Governor McKeldin appointed him chairman of a special advisory committee on conservation to work with the Maryland Tidewater Fisheries Commission.

Jurgen Ruesch, associate professor of psychiatry in the University of California School of Medicine, and his associates in the Department of Psychiatry and the Langley Porter Clinic, have been presented with the Hofheimer Award of the American Psychiatric Association. The research that won the award was published in book form in 1948 as *Duodenal Ulcer, A Sociopsychological Study of Naval Enlisted Personnel and Civilians*, by Jurgen Ruesch, Robert H. Harris, Carole Christiansen, Martin B. Loeb, Sally Dewees, and Annemarie Jacobson.

Thomas E. Snyder, who has been an entomologist with the Division of Forest Insect Investigations of the U. S. Department of Agriculture for more than 40 years, is retiring on June 30. A world authority on termites, Dr. Snyder will enter consulting work in September in Washington, D. C.

Edwin G. Williams, chief, Radiological Health Branch, USPHS, has been assigned as consultant in atomic medicine, Health and Special Weapons Defense Division, Federal Civil Defense Administration.

Colleges and Universities

Beloit College will operate a natural sciences field school August 30–September 15, with instruction in both geology and biology. The school will be conducted as a mobile camp, principally in the Grand Junction, Colo., area. Philip N. Joranson, of the Department of Biology, will supply further information.

Under the sponsorship of the **University of Cuyo** (Mendoza, Argentina), **Harvard Medical School,** and **Massachusetts General Hospital,** a medical group will conduct investigations of iodine deficiency in the Province of Mendoza during June, July, and August. Personnel will include Drs. Perinetti and Itoiz, of Mendoza; Drs. del Castillo and Truco, of Buenos Aires; Douglas Riggs and John B. Stanbury, of Harvard; and Gordon Brownell and Eleanor Brown, of the Massachusetts hospital. A complete laboratory will be established in Mendoza for work with radioactive iodine. The Boston members of the project will lecture in various South American medical centers.

The **Department of the Army** will begin a week's course in the Medical Aspects of Nuclear Energy July 9 at the Army Medical Center, Washington, D. C. Roy Maxwell, chief of the Biophysics Department, Army Medical Service Graduate School, will be head of the faculty of 17 experts.

The **Duke University Marine Laboratory** staff at Beaufort will be reinforced this summer by the presence of Raymond J. H. Beverton, senior scientific officer of the Fisheries Laboratory, Lowestoft, Eng., and W. Malcolm Reid, chairman of the Monmouth College Biology Department. Eleven members of the U. S. Fish and Wildlife Service will be on hand to study the population growth and fluctuation of commercially important fish, under the direction of Dr. Beverton.

At the request of the **Japanese Ministry of Education** and U. S. education authorities, a group of American educators headed by Wesley P. Lloyd will work in Japan this summer and fall to help reorganize Japanese university life and promote democratic relationships between faculty members and students. Three courses of three months each are expected to be given to about 240 Japanese professors at Tokyo, Kyoto, and Fukuoka. Members of the group, who will join Dr. Lloyd in Tokyo next month, are Morris Woolf, Chester Ruedisili, Leonia Feldsted, Henry Barrow, and Gordon Klopf.

The **University of Michigan** will hold its second summer Biological Symposium July 9–20 at Ann Arbor. Victor Hamburger, F. W. Went, W. U. Gardner, and C. M. Pomerat will participate in discussions of "Growth and Differentiation."

New York University will hold a series of three two-week workshops this summer to study and devise defenses for the current attacks on public education. The workshop will be under the direction of Walter A. Anderson and Herbert B. Bruner, who will be assisted by national officials of the National Education Association.

The **University of Pittsburgh** Graduate School of Public Health has created a department of biological chemistry and nutrition, with Robert E. Olson as professor and head. In addition to a teaching program, the department will engage in basic research in cellular physiology and will eventually open a nutrition clinic in cooperation with the School of Medicine.

The Virginia Hearing Foundation, being organized at the **University of Virginia** under the direction of Fletcher D. Woodward and James M. Mullenders, will offer a training center for specialists in diseases of the ear and provide a complete diagnostic clinic. Plans also include the establishment of a full-time traveling clinic.

Grants and Awards

Alpha Chi Omega, national women's fraternity, and the National Society for Crippled Children and Adults have awarded scholarships for graduate training in cerebral palsy to Ruth E. Cook, Frederick Darley, Murray M. Halfond, Marilyn J. Hill, Betty Jane McWilliams, and Alice S. Noel.

The University of Illinois College of Medicine has received the following grants: from **Asthmatic Children's Aid,** $10,000 for histochemical and immunological studies under B. Z. Rappaport; from **Swift & Co.,** $8,250 for a study of the relationship of bile to cholesterol, under the direction of A. C. Ivy; and from **G. D. Searle & Co.,** $5,540, for work on the effect of banthine on the motility of the small and large intestines, under the supervision of Michael H. Streicher.

The **U. S. Atomic Energy Commission** has awarded a total of 409 unclassified research contracts, 244 in biology and medicine, and 165 in physical sciences. In May new contracts in chemistry went to F. O. Rice, Catholic University, and James N. Pitts, Jr., Northwestern; in metallurgy, to C. Bonilla, Columbia, and C. A. Crowley, of Graham, Cowley & Associates; and in physics, to Lyman Spitzer, of Princeton. New contracts in biology and medicine went to Curt P. Richter, Johns Hopkins; James E. Gunckel, Rutgers; I. C. Gunsalus, Illinois; E. F. Frolik and R. Morris, Nebraska; Thomas G. Ward, Johns Hopkins; Jonas S. Friedenwald, Johns Hopkins; Robert B. Withrow, Smithsonian Institution; D. G. Cogan and D. D. Donaldson, Harvard; P. B. Hudson and J. M. Reiner, Columbia; and W. H. Taliaferro, Chicago. Thirty-eight contracts were renewed in the same period.

The **National Foundation for Infantile Paralysis** will support two projects in research on poliomyelitis at Mount Sinai Hospital, under the direction of Gregory Shwartzman and Horace L. Hodes. The grants total $91,852 and will extend over an 18-month period.

The **Charles Lathrop Pack Forestry Foundation** will

finance by a grant of $30,000 to the Department of Conservation, School of Natural Resources of the University of Michigan, a two-year investigation of land use in the cutover pineries of middle Michigan. The project will be under the direction of Stanley A. Cain, who will be assisted by four predoctoral students.

Parke, Davis & Co. has given Wayne University a grant of $30,000 to furnish and equip a teaching laboratory to be known as the Parke-Davis Laboratory in Pharmacy.

Phi Lambda Theta, the national association for women in education, has announced two awards to be granted on August 15 for significant research on the professional problems of women. Address inquiries to Miss Alice H. Hayden, University of Washington, Seattle 5.

Supplementing a grant of $150,000 from the Commonwealth Fund (*Science*, **113**, 640 [1951]), the **Rockefeller Foundation** has given $155,000 to the Health Insurance Plan of Greater New York for a four-year study of its experience, under Neva R. Deardorff, director of research and statistics of the Plan.

The **Wenner-Gren Foundation** has announced grants-in-aid and fellowships totaling $146,700 for the support of 10 projects in physical anthropology, 6 in archaeology, 28 in ethnography and social anthropology, 1 in linguistics, 4 in general and theoretical studies, and 15 in education and publication studies. Eleven predoctoral fellowships, with stipends of $1,500 each, have been awarded to advanced students of anthropology at the Universities of Arizona, California (Berkeley), Indiana, Michigan, and Minnesota, as well as at Columbia, Cornell, Harvard, Northwestern, and Stanford. Aid will also be given to the American Anthropological Association, the American Institute of Human Paleontology, Peabody Museum, the New York Academy of Sciences, the Society for American Archaeology, and the Wenner-Gren Institute for Biochemical Research (Stockholm). In addition, allocations totaling $37,000 were made for special Foundation projects.

Six Swedish research groups engaged in the study of cancer and its causes, as well as means of prevention and eradication, have received grants from the **Women's Guilds of the Cooperative Societies,** which in less than a year, by means of individual donations, collected the sum of 1,000,000 kr. for the purpose.

In the Laboratories

The **Atomic Energy Commission** is completing negotiations with the following groups of business and industrial firms for participation in reactor development projects: Monsanto Chemical Company, and its associate, The Union Electric Company of Missouri; Detroit Edison Company and the Dow Chemical Company; Commonwealth Edison Company and the Public Service Company of Northern Illinois; Pacific Gas and Electric Company and the Bechtel Corporation of San Francisco. No additional groups can be admitted at this time.

The **Bakelite Company,** a division of Union Carbide and Carbon Corporation, has appointed Victor H. Turkington director of research. Dr. Turkington was formerly superintendent of research and development at the company's laboratories in Bloomfield, N. J.

A new NBS laboratory center, to be known as the **Corona Laboratories,** will be established at Corona, Calif., for research in various phases of electronics research, development, and engineering. About 22 buildings on the site, turned over to NBS by the Navy, are being renovated. R. D. Huntoon, formerly chief of the Atomic and Radiation Physics Division, has been named associate director of the laboratories, which are expected to be in full-scale operation by September.

Fertilizers and Chemicals, Ltd., of Haifa, Israel, is planning a $15,000,000 expansion program scheduled to go into operation in 1953. Plants for sulfuric acid and superphosphate manufacture will be enlarged, and new ammonia and compound fertilizer plants will be added.

The following manufacturing affiliates of **General Electric Company** became G-E departments on June 20: Carboloy Co., Inc., Detroit; General Electric X-Ray Corp., Milwaukee; Locke Inc., Baltimore; Telechron Inc., Ashland, Mass.; Monowatt Inc., Providence, R. I.; and Trumbull Electric Manufacturing Co., Plainville, Conn.

Michael Reese Hospital, Chicago, dedicated its new **Institute of Psychosomatic and Psychiatric Research and Training** early in June. The training program, under John Spiegel, will include teaching of resident physicians who wish to become psychiatrists, medical students, social workers, nurses, occupational therapists, psychologists, and internees, residents, and staff doctors in other specialties. Twenty per cent of the space has been set aside for research.

Japanese Geon Company, Ltd., Kambara, Japan, has been formed by B. F. Goodrich and several Japanese industrial firms to manufacture Geon polyvinyl chloride. Construction and early operations will be under the supervision of Goodrich engineers; later the plant will be fully staffed by Japanese.

Mathieson Alabama Chemical Corporation, a new subsidiary of Mathieson Chemical Corporation, will build a chlorine and caustic soda plant near Mobile, to be in operation early in 1952.

Schenley Industries, Inc., has appointed three new vice presidents: Bruno Puetzer (research), James H. Noyes (production), and Samuel Miller (development). Drs. Puetzer and Noyes will be located at the Lawrenceburg, Ind., plant, and Mr. Miller in New York.

Meetings and Elections

New officers of the **American Association of Cereal Chemists**, elected at the Minneapolis meeting, are: H. K. Parker, president; J. A. Anderson, president-elect; F. R. Schwain, secretary; D. B. Pratt, Jr., treasurer; and W. F. Geddes, editor. The 1952 meeting will be held in Dallas, and the 1953 convention in Buffalo.

The **American Heart Association** has elected Louis N. Katz president for 1951–52. Irving S. Wright was chosen president-elect, and A. W. Robertson, of Westinghouse Electric Corporation, was elected to his fourth term as chairman of the Board of Directors. William H. Bunn was elected secretary, and Harry E. Ungerleider was reelected assistant secretary.

At its annual meeting in Virginia Beach, the **American League against Epilepsy** elected the following officers: president, Francis M. Forster; vice presidents, Benjamin Simon and John Kershman; secretary-treasurer, Jerome K. Merlis. The 1952 meeting will be held in Louisville, Ky., during the week of April 21.

The **American Psychoanalytic Association** has elected Robert P. Knight president for 1951–53; Ives Hendrick, president-elect; LeRoy M. A. Maeder, secretary; and William G. Barrett, treasurer. Philip R. Lehrman continues as the official representative on the AAAS Council. Forthcoming meetings of the association will be held December 6–9 at the Waldorf-Astoria, New York, and May 8–11 at the Chalfonte-Haddon Hall, Atlantic City.

Roy R. Grinker has been elected president of the **American Psychosomatic Society**; Sidney G. Margolin, president-elect, and Frederick C. Redlick, secretary-treasurer. The annual meeting for 1952 will be held at The Drake, Chicago, March 29–30. Titles and abstracts of papers for consideration for the program should be sent in duplicate before *December 1* to Dr. Roy R. Grinker, Chairman, Program Committee, 714 Madison Ave., New York City 21.

The **American Society for Engineering Education** has elected Morrough P. O'Brien vice-chairman of its Engineering Research Council, and A. A. Jakkula and Eric A. Walker directors. Four institutions have been elected to active membership in the Council: Columbia University School of Engineering; Mississippi State College Engineering and Industrial Research Station; Stevens Institute of Technology; and Utah State Agricultural College Engineering Experiment Station.

Phi Lambda Upsilon, one of the oldest honorary societies in the U. S., installed the Honorary Chemical Society of Syracuse University as the Alpha Tau Chapter last month, making a total of 43 ΦΛΥ chapters. Officers of the old society, who have become officers of Alpha Tau, are Kenneth J. Shaver, president; Reino W. Hakala, vice president; Harold L. Kall, secretary; and Harry Teicher, treasurer.

Miscellaneous

The American Museum of Natural History has placed Frank E. Egler, research associate in Conservation and Use of Natural Resources, in charge of a newly organized project, the "Vegetation Bibliography of the Americas." The project is intended as a service to scientists and technologists and will encourage, coordinate, and centralize the divergent activities in the Western Hemisphere. Regional bibliographies will be published as suitable material becomes available. If individuals have already searched the pertinent literature of some area, it is hoped they will communicate with the museum.

An **Associate Committee on Publication and Abstracting Services** has been set up by the National Research Council of Canada to work with similar organizations in other countries toward better dissemination of published records of scientific and technical work.

The Department of Agriculture Office of Personnel, Washington, is asking for 600 agricultural specialists to represent the U. S. abroad in technical cooperation programs, including the Point IV program. Areas into which they will be sent include Europe, Latin America, Africa, the Near East, and the Far East. Appointments are exempt from Civil Service examination, and applicants over 60 will be considered for some assignments.

Graphic Art in Sweden Today, a traveling exhibition that has been shown at the Worcester Art Museum, The Berkshire Museum, Pittsfield, Mass., and the Lyman Allyn Museum, New London, Conn., will be seen in July at The Architectural League, New York. Originally assembled by the Swedish Institute in Stockholm, it has also been shown throughout Canada.

Students in public, parochial, and private schools all over the country, winners in regional fairs sponsored by Science Service and local newspapers, competed last month in the **Second National Science Fair**, held at Washington University. Mary Helen Martin, 17, Hyattsville (Md.) High School, and Peter Miller, 18, St. Paul (Minn.) Central High School, won first place in the biological sciences. Barbara Evelyn Joy, 16, Aldrich Warwick (R. I.) High School, and Edmund A. Richards, 16, Belleville Township (Ill.) High School, won first place in the physical sciences. Last spring Miss Martin was one of the 40 Science Talent Search winners. The Fair judges were chosen from among scientists in St. Louis area industrial laboratories and universities.

Under the direction of Charles E. Balleisen, research specialist in automatic machinery and kinematic synthesis, **Southwest Research Institute** is equipping new and larger quarters for its Mechanical Laboratory. The laboratory is undertaking programs to analyze mechanical processes leading to improved production methods, applying quality control methods to inspection problems, and developing both full-scale equipment and functional models.

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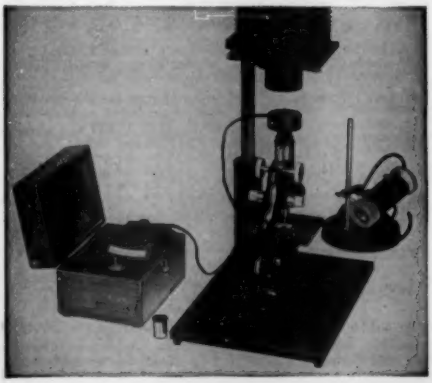

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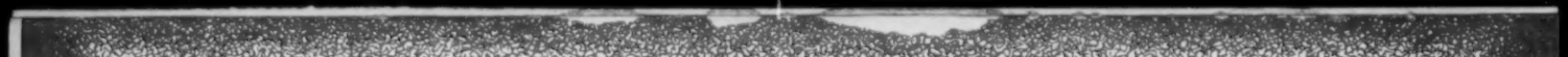
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